Remarks upon the Newtonian philosophy, as propos'd by ... Newton, in his Principia philosophiae, &c.; and by Dr. Gregory, in his Principia astronomiae physicae. Wherein the fallacies ... are ...laid open; and the philosophy ... proved to be false ... / [George Gordon].

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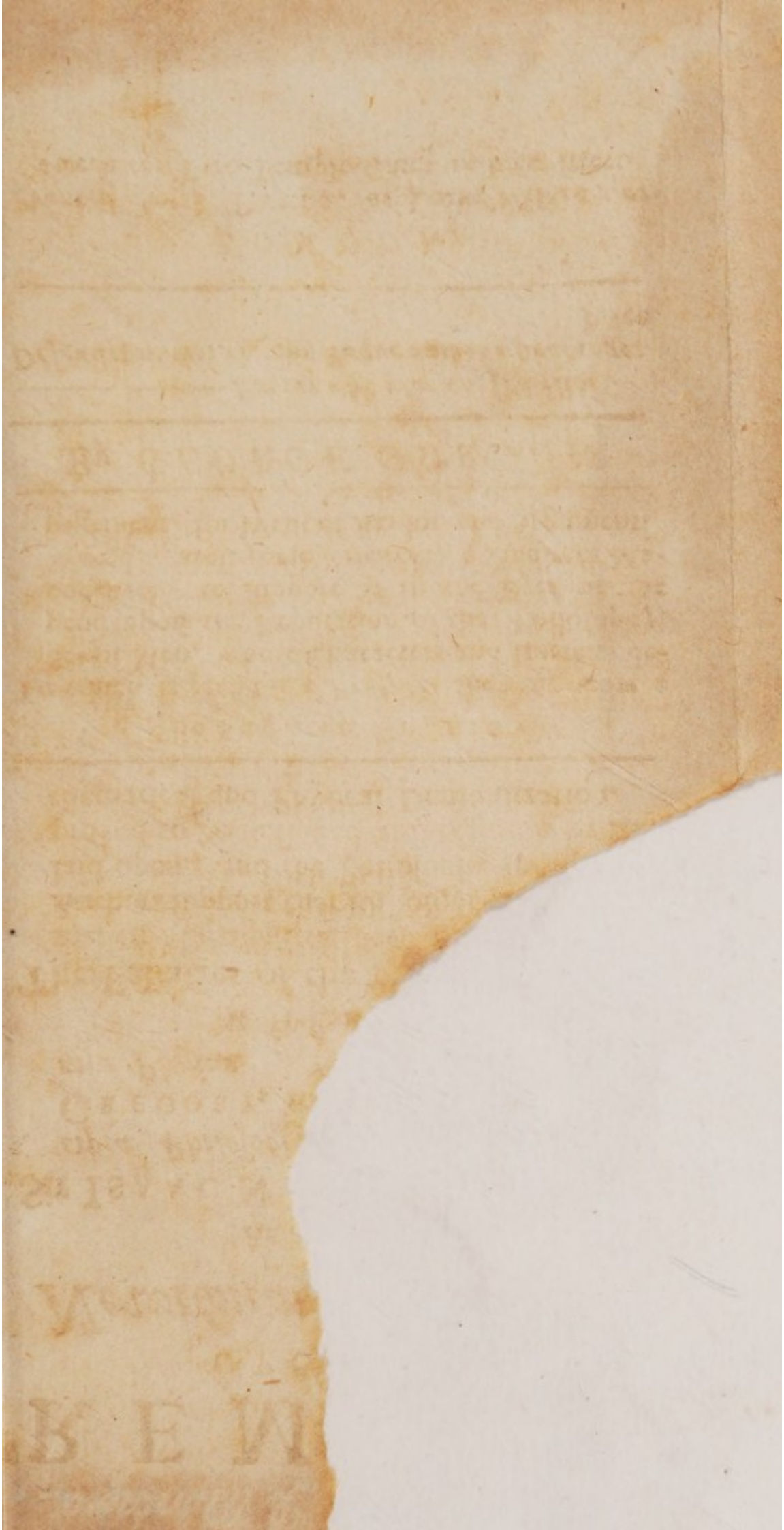

REMARKS

UPON THE

Newtonian Philoſophy,

As propos'd by

Sir ISAAC NEWTON, in his *Principia Philoſophiæ*, &c. and by Dr. GREGORY, in his *Principia Aſtronomiæ Phyſicæ.*

WHEREIN

The Fallacies of the pretended Mathematical Demonſtrations, by which thoſe Authors ſupport that Philoſophy, are clearly laid open; and the Philoſophy it ſelf fully proved to be falſe and abſurd, both by Mathematical and Phyſical Demonſtration.

The SECOND EDITION.

To which is prefix'd a *Preface*, ſhewing how a Set of Men, whoſe Characters and Intereſts depend upon the Reputation of that Philoſophy, endeavour to ſupport it in the Eyes of the World againſt theſe *Remarks*, by indirect Management, for Want of Reaſon and Argument.

By *GEORGE GORDON.*

——— ——— Faciunt hi plura: ſed illos
Defendit numerus, junctæque umbone phalanges.
Juven.

LONDON:

Printed for J. PEELE, *at* Locke's-Head; *between the* Two Temple-Gates *in* Fleet-ſtreet.

THE PREFACE.

WHEN *I wrote these* Remarks *upon the System of the World, as it is modelled by Sir* Isaac Newton, (*which is what we call the* Newtonian-Philosophy,) *I imagin'd that the Part of Nature, of which I had chosen to write, was a Subject wherein Mens Passions and Interests were no ways engaged. I knew there was no Party that accused the Sun of Tyranny, for scorching a great Part of our Globe with intolerable Heat, and leaving another Part almost destitute of his Influence; nor any Faction that proposed to raise it self by rebelling against that glorious Monarch of the World. I knew there was no Set of Men that had a Plot of pulling down* Saturn *from his Orbit, for his Malevolent Aspects; nor of advancing* Jupiter *to a higher Station in Nature, for his friendly Influences. I knew that*

no Sort of Perſons were diſaffected to the Government of the Soveraign Natural Cauſe, which at preſent rules the Motions of the beautiful Syſtem of the World. In fine, I knew that no Part of the Univerſe was in fear of a Rival, nor ſtood in Need of a Party to defend it in the Exerciſe of its Office, or gave to its Adherents ſuch Rewards as do engage Mens Paſſions and Intereſts, and make Parties in the World: And from thence concluded, that Mens Paſſions and Intereſts were no ways concerned in theſe Affairs. That in theſe Matters, Men wanted no more but to know what was Truth, and what was Error; and that being unbyaſſed, nothing would be needful for perſwading them what was ſo, but clear Evidence, and ſound Arguments only.

Having this View of what I had undertaken, I was at no Pains to guard my Reader againſt thoſe Arts by which Parties practiſe upon Mens Credulity. I did not court my Reader for gaining his Favour, nor ſo much as make him the common Complement of a Preface; neither did I uſe any of thoſe Arts by which Authors make a Handle of Mens Paſſions to perſwade them, but apply'd my ſelf to the Underſtanding only. I imagin'd alſo that αὐτος ἔφη *was a Maxim in Philoſophy now antiquated, and that this diſcerning Age would not (at leaſt in this Part of Phyſicks,) be ſo blind, as to make Authority the Touch-Stone of Truth, which had all along recommended groſs Errors inſtead of it. And this it was that made me not afraid to oppoſe clear Evidence, and ſound Argument, (in that Affair) to the Authority of Men of the greateſt Name, nor endeavour to get any Authority to back my Arguments. I did not join*

my

my ſelf to any Party, that their Countenance might ſupport me in my Undertaking; nay, I did not ſo much as ſeek for the Approbation of any one Man of great Name, thereby to recommend my Performance to the World; neither did I ſtudy to ſupport what I advanced by any of thoſe Methods which are proper to be taken in all Caſes where Authority is lock'd for, or where Human Paſſions and Intereſts are concerned. My only care was to advance nothing but Truth, and to ſupport it by ſuch Arguments as ſhould be able to ſtand againſt the moſt powerful Objections. And if (as I imagined) Mens Intereſts and Paſſions had not been concerned in my Subject, nor themſelves guided by Authority, and that they had wanted no more than to have Truth ſhew'd them, it had certainly been moſt proper to ſhew it (as I did) dreſs'd with nothing but clear Evidence and ſound Arguments; becauſe theſe are the only Ornaments that make it ſhine in its full Luſtre. And certainly unbyaſſed Perſons muſt have known it better, and embrac'd it more readily, when appearing in that plain and artleſs Condition, than if it had been recommended to them by pathetick Speeches; ſupported by Numbers; joined by Parties; approved of by Men of great Name; or attended with any of the reſt of that Kind of Retinue, which oftener accompany Falſhood than Truth; and are in Reality, neither Marks of Truth nor Falſhood. But as it has happen'd that I was miſtaken, in thinking that Men were not guided in thoſe Affairs by Authority, and that their Paſſions and Intereſts were not concerned in my Subject; ſo this Miſtake has occaſion'd my taking a very unfit Method of recommending my Opinions to the World, and

made me neglect the proper Means of Perſwaſion.

I might eaſily have known, that in ſuch ſublime and difficult Matters, few have Capacity and Courage enough to think for themſelves, and that the Weakneſs of Human Underſtanding in the Generality of Mankind, does in theſe Matters as naturally lead them into a Submiſſion of their Judgments to the Opinions of thoſe who pretend to inſtruct them; as the Impotence of Human Nature, to ſupport it ſelf without Society and Government, leads Men into a Submiſſion of their Civil Concerns, to ſuch as have the Courage to aſſume a Superiority and Juriſdiction over them. All the Choice Men have in any of theſe Affairs, being (in Caſe of a Competition among thoſe who dare be great either in the civil or learned World,) that they may chooſe to which of the Competitors they will ſubmit. But in both theſe Affairs, the Bulk of Mankind are by an irreverſible Decree of Nature obliged to ſubmit: And therefore, they have not only done ſo in preceding Ages, and do ſo now, but muſt continue to do ſo while Human Nature continues the ſame: So that I was widely miſtaken, in thinking that in thoſe Matters of which I wrote, Men did not depend upon Authority now, as they did in former Ages; and that they are not now as liable to be led into groſs Errors by that Ignis Fatuus, as their Fore-fathers.

It was a Miſtake in me no leſs groſs than the former, to believe that Mens Paſſions and Intereſts were not concerned in my Subject, ſince I might eaſily have known, that tho' the Parts of the Univerſe themſelves could not ſtand in Need of a Party to keep them in their Offices; yet that theſe

Opini-

Opinions of Philoſophers concerning thoſe Parts, to which Men do at preſent ſubmit, might want to be kept up in the Eyes of the World. I ſhould have known alſo, that they who teach the World theſe Opinions, have in Return, receiv'd from the World Eſteem, Wealth and Honour; ſuch Rewards as are moſt agreeable to Human Nature: That the Continuance of theſe Advantages, in a great Meaſure depends upon ſupporting the Credit of thoſe Opinions from which they aroſe: And conſequently, that theſe Men are, by their Paſſions and Intereſts, as directly engaged to ſupport their Sentiments in the Eyes of the World; as they who enjoy the beneficial Offices of the State, are to ſupport that Government, in which they are engaged.

It is not only plain, that the Poſſeſſion of high Stations in the Learned, as well as the Civil World, engage; but alſo, that they enable the Poſſeſſors to ſupport that from whence ſo great Advantages ariſe to them. For eminent Places among thoſe to whom we ſubmit in the Affair of Learning, not only carry along with them great Advantages, as well as high Offices, among thoſe to whom we ſubmit in Civil Concerns; but alſo, the great Men who have the Adminiſtration of the Affairs of the Learned World, are capable in their Way, by Intereſt and Commendations, to reward their inferior Adherents, with an inferior Degree of thoſe Bleſſings which themſelves enjoy, and ſo engage their Paſſions and Intereſts in the Affair alſo; and thereby bind them to concur and aſſiſt in ſupporting the common Cauſe: As well as Stateſmen can ſtrengthen that Government of which they have the Adminiſtration, by putting whom they think

most proper for that End, into the inferior Offices of the State. And Experience shews us, that in the Affair of Learning as well as Government, the implicit Crowd, who neither understand, nor have any Interest in the Matter, without having any other Motive but their being engag'd, and habituated to join in the Affair, are almost as strenuous and passionate in supporting the common Cause, as those whom Interest binds to it: And implicit Ignorance secures the former as much from being overcome by good Arguments, as Passion and Interest does the latter.

In short, it is evident, that whether in the Affair of Learning, in civil Concerns, or in any other Matter, suitable Encouragement breeds Parties; and where any Thing affords so considerable an Encouragement, as was that universal Applause, with which the Newtonian Philosophy *was received in the World; there a Party to espouse the Cause, does as naturally and necessarily spring from such Encouragement, as Grass springs from a good Soil that affords it sufficient Nourishment. So that they who have listed themselves Followers and Admirers of Sir* Isaac Newton *and his Opinions, are a Party produc'd, and subsisting upon the same Motives as other Parties, and altogether of the same Nature with them; and their Conduct in supporting their Party, being the Effect of the same Cause, must also be the same as the Conduct of other Parties: And he knows but little of the Affairs of the Learned World, who knows not how considerable that Party is in it. For first, the* Newtonian Philosophy *is so mysterious, that all Mankind (a very few only excepted) are ignorant in that Point, and belong to*

that

that Class of Men, who are under a Necessity of submitting their Judgments; and there having been no considerable Opposition made to that Philosophy since its Publication by any Competitor, these Men have hitherto hardly had any Choice; but have been all obliged to embrace that Philosophy. Upon the other Hand, those very few, who understand that mysterious System, have not attained that Piece of Learning without a great deal of Study; nor is it to be supposed that Men would put themselves to so much Trouble as that Attainment requires, without a Prospect of being at least esteemed by the World for so uncommon a Piece of Learning; or even if a meer Inclination to Study should have supported some under the Fatigue of studying over Newton's Principia, *yet who is so self-deny'd as not to conceive a greater Opinion of himself, and endeavour to appear something more in the Eyes of the World, when he finds himself Master of so rare a Piece of Knowledge, which alone is sufficient to intitle him to the Character of a Man of bright Parts and deep Learning? In short, it's plain, that by far the greater Part of those who understand that Philosophy, both value themselves, and are valued by the World, upon that Account; and are by their Passions and Interests consequently engaged in the Party. And at this Rate, how considerable, and how powerful this Party is, I think sufficiently appears.*

But as plain and evident as all this appears to me now, yet I reflected not upon it, before Publishing these Remarks, *when it was the proper Time to have done so; and never found it out, till I saw myself attack'd by a strong Party in the*

most

most injurious Manner; and then Experience, the Schoolmaster of Fools, taught me to understand whom I had offended. I imagin'd when I publish'd these Remarks, *that I had nothing to fear but the Objections that might be made against my Arguments, and the Faults that might be found in my Reasonings; but to my Surprize, I found that neither Objection nor Reason was used against me; but the Party whom I had offended, sensible of their own great Strength, and of my Weakness, of the great Credit and Authority they had got in the World, and of my being destitute of either, contented themselves (instead of objecting) with telling the World that I and my Arguments were silly, and not worth their Notice; and by the Strength of their Credit and Authority together, with the most unjust and injurious Management, have got the World to depend upon their Character of my* Remarks, *and prevailed with them not to examine the Matter, but to take all from them upon Trust.*

If I believed that Men had submitted themselves to Sir Isaac Newton *in Philosophy with this View, not to put themselves any more to the Trouble of using their Reason in that Affair, or of being solicitous what was Truth and what was Error, and resolv'd henceforth to take that for Truth which he affirmed to be so, whether it were true or false; if I believ'd, I say, that the World had in this Manner submitted to Sir* Isaac, *the Respect due to Mankind from every Individual, would oblige me also to own him for my lawful Governour, whom all Mankind had chose for theirs. But I well know that those who are most strenuous in his Behalf, (a very few only excepted) are so, neither for*

their

their own Interest, nor out of any particular Regard to his Person, but because they believe his Opinions to be true, and his Arguments to be good; whereas if those Men knew how much they are abused by them who have made them believe so, they would act a quite different Part: And therefore it is neither opposing those Men, nor any Disrespect to so considerable a Part of Mankind: For one, who sees how much they are abused by designing Men, to endeavour to disabuse them, which was the Design of these Remarks, *wherein I have shewed them, if they would allow themselves to see, that the Philosophy which they are so much taken up with, is grossly absurd; and the Arguments that support it, meer Sophistry. And the Design of this* Preface *is to shew how those same Men continue to abuse them, and hinder them from looking at Truth, when clearly proposed to them; and how they injure me in making the World believe that my Arguments are silly, because they cannot answer them. And the Conduct of that Party, in opposing my* Remarks, *is such, that I am convinc'd the bare Narration of it (which is what I have further to say at this Time,) will make the Truth appear.*

Some Time before Publishing of these Remarks, *a Friend of mine wrote to his Correspondent at* Oxford, *that such a Book was to be published, that some were to be sent to* Oxford, *and that he desired of him to engage some* Booksellers *to sell them there. My Friend received Answer, that such a Book would not take in that Place; but certainly be neglected. And I was so dull as to laugh at the Gentleman's Foresight, who pretended to know what Reception a Book would meet with,*

before

before he knew what Reception it would deſerve; but the Event ſhewed him to be in the Right, and me to be the Perſon that deſerved to be laugh'd at, for not having foreſeen as he did, that its Reception depended upon the Strength of the Party who were engaged to oppoſe it; a Thing very different from what I imagined was to determine its Reception. For ſome Time after Publication, the ſame Gentleman wrote, that as he foreſaw, ſo it happened; for though the Book had been expoſed to Sale for ſome conſiderable Time, in the moſt noted Bookſellers *Shops in* Oxford, *there had not ſo much as One been ſold, and that every Body there believ'd it to be ſilly and not worth reading.*

It appears from this Story, that every Body condemned, and none would read the Book; and condemning a Man unheard, I think will be eaſily allowed to be the higheſt Injuſtice. It will alſo appear from a very little Reflection upon the Uncommonneſs of the Nature of the Book, and from the Nature of the Place, that ſome would have been bought at firſt, tho' the Book had been ever ſo ſilly, if extraordinary Care had not been taken to perſwade every Body timeouſly that it was ſilly: Nay, any Man that will impartially reflect upon ſuch an univerſal Abſtinence from reading ſuch a Book in ſuch a Place, and at the ſame Time that the Men of Letters there are all in a Manner connected together, will eaſily ſee that which was really the Caſe; that ſome of the Leading Men in the Univerſity uſed their Intereſt with the whole Society, to hinder them from reading: For merely giving a bad Character of the Book would never have ſatisfy'd every one's Curioſity ſo fully, but

that

that ſome one or other, would have had the Curioſity to read it. It appears alſo, that the Management which was neceſſary for effecting the Matter ſo as it happened at Oxford, *is exactly oppoſite to real Neglect: And the Fate the Book had, of not being bought at all at firſt, and being bought afterwards, is alſo the Reverſe of the Effect of Sillineſs, in a Book that promiſes great Things: For Experience ſhews us, that when Men really deſpiſe a Book, they let it alone to take its Fate; and thoſe whoſe Opinions it may contradict, are at no Pains to hinder Men from reading it; becauſe like Patches which makes the Face ſeem whiter, ſuch Performances do Service rather than Hurt to what they oppoſe; and contrary to the Fate of my Book at* Oxford, *ſuch Books always ſell at firſt, and not at all afterwards; but it's needleſs to inſiſt upon theſe obvious Reflections; ſo that I ſhall proceed in my Narration.*

Some Time after Publication, one Mr. Græme, *a Friend of mine, who had read the Book, and underſtood the Subject perfectly well, happened to go to* Edinburgh, *where he found that it had the very ſame Fate and Character as at* Oxford. *And not only ſo, but that it was there loaded with a great many unjuſt ill-natur'd Calumnies; ſuch as that the Name prefix'd to the Book, was not the Author's Name, but a borrow'd one, and the like.* Mr. Græme *declar'd himſelf openly for the Book in all Companies, and made it his Buſineſs to Converſe with the moſt noted Mathematicians in Town upon the Subject; but when he came to Particulars, he found that they had not read the Book. He entreated ſeveral to read and conſider it, and after ſo doing, to point out its Faults to*

him;

him; but could hear of no particular Objections that were made by any Man, nor prevail with any to point out its Faults; ſave only that one of thoſe to whom he apply'd, ſhew'd him ſome written Objections, which it ſeems were handed about, and ſhew'd to proper Perſons; but at the ſame Time exacted a Promiſe of him, that he ſhould neither diſcover the Objections, nor his Name, or the Name of the Author of theſe Objections; ſo that I could not prevail with Mr. Græme *to tell me any more of this Story, than in general that the Objections were very weak, and only fit for ſatisfying ignorant People: And that being the Objections of a Man of Reputation, if he had been at Freedom to diſcover the whole Matter, it would have been of great Uſe to me, in ſhewing to the World the Scarcity of Argument which thoſe who oppoſe me labour under. He further told me, that tho' the Perſon who ſhew'd him the Objections, made him promiſe Secrecy; yet he is of Opinion, that he might have prevail'd with him to releaſe him from that Promiſe, if he had not unluckily expoſed to him the Weakneſs of the Objections in ſuch a Manner, as to give him a full View of the Danger of allowing him to do ſo to others.*

It is in vain for me to trouble the Reader with my Reflections upon this Fact, it being ſo plain that the Pretence of the Book's Sillineſs was inconſiſtent with the Conduct of thoſe who pretended it; for if the Book had been ſilly, it would not have been ſo hard a Matter to prevail with ſome Body to point out its Faults; neither would thoſe who endeavour'd to do ſo, have been ſo careful in concealing what they ſaid upon the Head. In ſhort, this Fact ſhews clearly the Weakneſs of my Oppo-

nents

nents in Argument, and their Strength in Credit and Authority; and that they dare make no manner of Uſe of the former, but muſt depend wholly upon the latter for the Defence of their Philoſophy againſt theſe Remarks.

I come now to the Reception my Book had at London, *which I can give a more full Account of, becauſe I was there my ſelf. Some ſmall Time before publiſhing, one of the* Bookſellers *whom I had employ'd, deſir'd me to employ alſo a Friend of his, one Mr.* Taylor, *and bid me put his, together with the Names of the reſt of the* Bookſellers, *to whom the Title directs* Buyers, *which I did; and he at the ſame Time, ſent Mr.* Taylor *Word what he had done; who returned Anſwer, that he would not for Five Pound have his Name in the Title of ſuch a Book, and if it was put in, he would ſeek Redreſs of the Injury by Law; ſo that I was obliged to alter the Title and take out his Name. This extraordinary Manner that Mr.* Taylor *took to reſent being employ'd in his Way of Buſineſs, was the firſt Thing that made me begin to foreſee what Kind of Oppoſition I was like to meet with; but it was not then Time to think of uſing Means to prevent it.*

The Day of its Publication, I made a Preſent of One to a Club of Mathematicians, who meet every Monday-Night *under the Denomination of the* Mathematical-Club; *but one Mr.* Foulks, *who happen'd to be there at that Time, carry'd it away with him, and has kept it ever ſince, and would not return it, tho' the Club ſent their Steward on purpoſe to get it back; ſo exact Care was there taken to hinder the* Hereſie *from taking Root in that Company.*

The Greatneſs of this Place however, made it impoſſible for them here, as at Oxford *and* Edinburgh, *to hinder every Body from buying, tho' they were not wanting in their Endeavours that Way; but they fell upon ſomething equivalent, which was to hinder the* Bookſellers *from ſelling. How far they ſucceeded in this, and what Methods they uſed, I will not affirm farther than I have Evidence, tho' I have good Reaſon to ſuſpect much more. One told me that when he called for the Book at* Mr. Brown's *Shop, his Shop-keeper was at a great deal of Pains to give a bad Character of it, which it's plain he would not have done of his own Accord, it being directly againſt his Intereſt to hinder the Sale of his Goods; and another who called for the Book at the ſame Shop, had for Anſwer, that they had None but what were in the Ware-Houſe; which was falſe: For at that Time they were in the Shop. Another of the* Bookſellers *alſo, acknowledg'd he was forbit to ſell it. Now theſe Facts ſhew that there have been Endeavours uſed with ſome of the* Bookſellers, *and I ſee no Reaſon to queſtion the like of the reſt; and it's very evident how powerful the Party who oppoſe me muſt be with the* Bookſellers, *and how imprudent it muſt have been in them to diſoblige ſo conſiderable Cuſtomers, for any ſmall Matter they could expect from the Sale of my Book.*

By this Time, I ſaw that the Management of thoſe who oppoſed me, was to give the Book a bad Name, and hinder People from ſeeing it; leſt they ſhould be undeceived. To oppoſe which Management, I uſed all the Intereſt I could among my Acquaintance to get them to read the Book,

and

and to desire their Acquaintance to do the like, which several did; none of which found any Fault with it. I then further desired them, that in any Companies where they happened to be when it came in their Way, they would be so just as to declare their real Sentiments of the Book, which they promised to do; but these my Endeavours were by far too weak to oppose the Party which I had to deal with: For some of those who had read the Book, and promised to declare their Sentiments of it, in a little Time afterwards told me, that the Report of the Book being extremely silly, and its Author being an ignorant enterprizing Fool, was so very strong, that by commending it, they were afraid to get such a Character themselves. Others told me, that they were ashamed to contradict so many as opposed them with so much Assurance. One told me, that he had in several Companies freely declar'd his Opinion of the Book; but that he had been severely check'd for so doing by one of his best Friends, and forbid to do so any more, and that I must excuse him for complying. This Person's Name, together with his who forbid him to speak any more in the Behalf of my Book, I would gladly publish, because the Story is somewhat remarkable; but that this were doing my Friend who told me the Story an Injury, and giving his Friend greater Ground to blame him.

One, of whom I expected that he would have exerted himself strenuously in my Behalf, who had a pretty general Acquaintance, told me that he had shew'd the Book to several who understood the Subject, and had no great Temptation to be partial: That he was fully satisfy'd by their concuring Sentiments as well as his own, that there was no Ob-

jection of any Value to be made againſt me. But that he would take the Liberty to tell me what they alſo ſaid, and what himſelf thought, which was, that I could not but know, that the moſt Eminent Men for their Learning in the World had not only approved of, but highly commended to the World the Newtonian Philoſophy, as one of the greateſt Improvements of Learning. That a great many of thoſe Mens Writings by which they have made themſelves famous, are either built upon this Foundation, or neceſſarily connected with it. And conſequently, that telling the World (as I do) that this Philoſophy is meer Fiction and Abſurdity, and its Arguments no better than Sophiſms, is attacking thoſe Men in the tendereſt Point, and in the moſt provoking Manner. That I could not expect leſs then that they would, in return, endeavour to vilify me and my Performance. That I was no ways provided for an Engagement with ſo powerful a Party. And tho' my Arguments were good; yet good Arguments, eſpecially in a Matter ſo little underderſtood, would not be ſufficient to convince the World without any Body to back them, when every Body oppoſed them: And tho' clear Truth would in Time prevail, yet it was hard to ſay how long ſo ſtrong a Party might be able to make it paſs for Falſhood in the Eyes of the World: perhaps longer than I ſhould live. And if ſo, that by my Undertaking I had occaſion'd my ſelf to be made appear during Life, in the Eyes of the World, a ſilly enterprizing Fool; which is more inconvenient than to be and not appear ſuch. That upon the Whole, I had acted a very imprudent Part. That he was too weak to help me; and that if he ſhould endeavour it, he ſhould only be

be able to hurt himself in the same manner as I had done; which were to act the same imprudent Part, for which he blamed me. He also told me, that such of my Acquaintance as understood not the Subject, believed the common Report; that such as understood it were of his Mind; and that though perhaps they were not so free as to tell me so, yet they would no more appear in my Behalf then he would.

This so very plain and close Reproof, gave me no small Uneasiness; it vexed me to think that my Acquaintances look'd upon me to be a Fool, and that none of them would assist me; nay, it vexed me much more when I reflected, that these Sentiments and that Conduct of theirs, was what I could not blame them for; and that the whole Blame lay upon my self, for not seeing what was so obvious. In short, I was upon Reflection, not only vexed, but surpriz'd at my own Dulness, and wondered how I came to imagine that a Set of Men, the most famous in the World for their Learning, would tamely suffer that with which their Reputation was necessarily connected, to be vilified in the Eyes of the World, by one who appear'd to be in no condition for making good such an Undertaking: How could I think that they would not hinder a thing so dear to them as their Reputation, from being thus impair'd, when they saw it in their Power to do so. Are human Passions become so weak, and Men so disinterested? or is it to be believed, that they will so freely part with what is most dear to them, for the sake of Truth only; nay, for the sake of such a Truth as very little concerns Human Affairs, when we see them every where maintaining Errors which are

destructi-

deſtructive of Mankind, rather than forgo their Paſſions and Intereſts? Or how could I believe, that the Party, whoſe Philoſophy I impugn, would ſuffer their many Writings which are connected with that Philoſophy, and muſt ſtand and fall with it, to be all overturned? Are Authors ſo eaſily induced to ſuffer their Writings (thoſe Children, of the Underſtanding, which are as naturally dear to Men as the Fruit of their Body,) to be thus ſnatch'd away from them, when it is in their Power to hinder it? Or if perhaps I was not quite ſo ſtupid as to foreſee no Oppoſition, and expect that theſe Men would at firſt yield the Cauſe; yet certainly I was ſo dull as to forſee no Method they would take of oppoſing me, but by Argument, which was almoſt as great Stupidity as if I had forſeen no Oppoſition at all. For what is more evident, than that the Effect of their uſing Arguments againſt me, was to make the World look into the Matter. And this was what I ought to have known they would be obliged to avoid; for I knew that the Abſurdity of their Philoſophy, and the Defects of thoſe Arguments by which it was ſupported, had lain hitherto ſafe from Obſervation, only by being cover'd from View with Obſcurity: That now, when I had drawn the Curtain of Obſcurity, and ſhew'd them naked to the World, nothing would do but to hinder the World from looking; and that if they themſelves by anſwering my Arguments, ſhould have cauſed the World to look into the Matter; This had been doing my Work for me, and pulling down their great Diana *with their own Hands, which it was unpardonable Dulneſs in me to expect from them. Beſides, how could I imagine, that they who*

were

were conſcious to themſelves, of being ſo highly honour'd by the World's Eſteem, would not take Care upon ſuch an Occaſion, to make uſe of that high Dignity, which in the Eyes of the World gave them a Title to deſpiſe what was ſaid by one ſo much below their Quality; and excuſed them from ſtooping ſo low, as to reaſon Matters fairly with a Man of no Name; or from bringing themſelves upon a Level with ſuch a one, by uſing Arguments of which he might happen to be no worſe provided than themſelves. But above all, how could I think that they would endeavour to uſe Arguments, when I knew they had none worth uſing? Or how could I forget, that they had Number, Authority, Reputation and Intereſt, which are Means much fitter for ſupporting their Opinions in the Eyes of the World? How could I think that a Set of wiſe and learned Men would neglect to make uſe of thoſe Weapons in their own Defence, of which they found themſelves provided, or that they would endeavour to defend themſelves with ſuch Weapons as they knew they were altogether deſtitute of: when mere Inſtinct teaches the very brute Creatures this Diſcretion, as the Poet very elegantly expreſſes it.

Ut, quo quiſque valet ſuſpectos terreat, utque
Imperet hoc natura potens, ſic collige.——
Dente Lupus, Cornu Taurus petit. Unde, niſi intus
Monſtratum? ——————— *Hor.*

I might have attacked a Lion, upon Suppoſition that he would only puſh at me with Horns, and that he would make no uſe of his Claws or Teeth,

as

as reaſonably as I did attack this Party upon the View of their uſing nothing but Arguments; neither would the one Raſhneſs have engaged me in a more unequal Combat than the other has done; for the queſtion betwixt them and me is, who ſhall convince the World that what they ſay is true, and they have not only Authority, Reputation, Intereſt and Number, very powerful Means, upon their ſide; all which I am utterly deſtitute of: But what is more uſeful to them than all the reſt, they themſelves have the only Title to judge betwixt them and me. For all that I can do upon my part is, to bring Arguments to prove what I advance, and the Queſtion being to convince the World, the Sufficiency of theſe Arguments muſt be judged of by ſuch as the World eſteems to be moſt capable to judge in that Affair: And all thoſe who are eſteemed by the World for their Capacity that way, are by that very Eſteem engaged to oppoſe me, becauſe they have all joined in with the Newtonian *Philoſophy, and highly commended it to the World, and muſt loſe ſome ſhare of that Eſteem, if they cannot ſupport the Credit of that Philoſophy.*

Theſe and ſuch like Reflections upon the unequal Combat in which I had engaged my ſelf, gave me a very melancholy Proſpect of the Event; and when I reflected upon the groſs Overſight which had brought me upon that Lock, I was almoſt quite out of Conceit with my ſelf for my Dullneſs, which I found to be the greateſt Uneaſineſs imaginable: For nothing is a more eſſential Ingredient in the Enjoyments of Life, than that good Opinion which every one naturally has of himſelf. Sometimes I endeavour'd to recover my own Eſteem

ſteem, by reflecting that it was my extreme Regard for Truth and ſound Argument, which ſo intirely took up my Mind as to leave no Room for any Thing elſe; whereas if my Mind had not been ſo much taken up, I ſhould have been as ready to ſee what was obvious as another Man. But ſtill methought it was ſilly to be ſo much taken up with ſo unfaſhionable a Thing as Truth, and to neglect what much nearlier concerned me; and that it look'd as Ridiculous, as to ſee a Fellow ſo intent upon gazing at the Stars while he walks along, as not to ſee a Stone that lies in his Way, till it break his Shins. I endeavour'd alſo to palliate my Error in my own Eyes, by bringing great Examples to juſtify it; as that Story of Archimedes, *who was ſo much taken up with the Contrivance of a Machine for the Defence of a Beſieged City where he was, that he did not ſee the Enemy who took the Town while he was at his Meditations, nor uſed any Means to provide for his Safety; but was catch'd napping at his Studies by the Soldiers, and kill'd. I brought alſo ſeveral Examples of that Nature from our great Man Sir* Iſaac Newton, *who has often been obſerved to be ſo intent upon Contemplations of Things a little out of the common Road, as not to ſee what was obvious to every Body elſe: As the Story that is reported of him, that while he was walking the Streets in a deep Meditation, inſtead of Piſſing againſt a Wall, he Piſs'd in an Apple-Woman's Basket of Fruit, and never was ſenſible of his Miſtake, till he was awak'd out of his Studies by the Clamour of the Woman reſenting the Injury done her. Juſt ſo I never underſtood whom I was offending, till I was awak'd by their Reſentments;*

ſentments; ſo much my Mind was taken up with Things ſo far out of the common Road, as Truth and good Arguments. I could have brought a great many more Inſtances of this Kind, for juſtifying my Error by great Examples, but that would not ſatisfy me; for it appear'd to be but very ſmall Satisfaction to reſemble theſe great Men, in that wherein they were moſt unlike themſelves.

Notwithſtanding my Diſſatisfaction with my ſelf for having made ſuch a raſh Attempt, yet being engaged, I was under a Neceſſity of proceeding in it in the beſt Manner I could. And the Means I next thought of, was to deſire of my Acquaintances, that tho' they would not take my Part, yet they would endeavour to get me Notice, what Reaſon they who gave a bad Character of my Book, would give for their ſo doing. In which Affair, they did exert themſelves in my Behalf, as much as I could have expected. They told People, that tho' they did not queſtion ſince it was every Body's Opinion, but the Book might be ſilly, yet they would gladly know what were its particular Defects: And for a pretty while after Publication, they could get no Satisfaction to that Queſtion, but this; That it was certain that Dr. Halley (one whoſe Capacity for judging in ſuch a Subject was not to be queſtion'd,) had the Day after the Publication, and at ſeveral other Times, in ſeveral Publick Companies, given the Book the ſame Character as they did.

When I heard this, it did me the Favour to cure me perfectly of that bad Opinion which I had for ſome Time entertained of my ſelf; for by this Story it appear'd, that the reſt of the World were

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as ready as I was to fall into groſs Miſtakes; and what gave me the fuller Satisfaction was, that I ſaw the World's Miſtake and mine to be the very ſame; ſo that I found ſufficient Shelter for my Error under the Excuſe of Human-Frailty, and ſaw that I had no better Reaſon to undervalue my ſelf for being obnoxious to thoſe Weakneſſes which all other Men are liable to, than for not having Limbs made of Braſs: And indeed who ought to be diſſatisfy'd with himſelf, or blam'd by others, for thoſe Infirmities which are common to Mankind?

Now it appeared to me, that the reſt of the World foreſaw no Reaſon more than I did, for queſtioning but that the Book would meet with ſuch Reception, and get ſuch a Character from the Learned as it deſerved. I before did not foreſee that Kind of Oppoſition which it happened to meet with, and they now did not ſuſpect it. In ſhort, their Miſtake and mine were in themſelves every Way the ſame, and differed in Circumſtances only; nay, I cannot ſay that my Miſtake was quite ſo groſs as their's: For tho' I was ſo far miſtaken as to expect a juſt Sentiment of my Performance from the Generality of the Learned World, and did not ſee how generally they were engaged againſt me, nor what Methods they would take in oppoſing me; yet to do my ſelf Juſtice, I never was ſo dull as to expect a juſt Sentiment of it from Dr. Halley. *So that the World in this Point exceeded me in Inadvertence; and were I not ſo deeply engag'd my ſelf in that Error, I ſhould be ready to complain of the World, for not remembring that ſomething beſide Capacity is requiſite to make a Man a good Judge;*

ſince it is univerſally known, that Diſintereſtedneſs and Integrity are much more wanted in thoſe who aſſume that Office: And certainly the World could not have imagin'd the Doctor to be furniſhed with any of thoſe Qualifications for judging of my Book, if they had reflected upon the Matter; and I ſhould have thought it needleſs to ſuggeſt to them ſuch an obvious Reflection, were it not that by their not having reflected upon it, they have demonſtrated the Reflection not to be ſufficiently obvious.

All I ſhall ſay to ſuggeſt the Reflection of the Doctor's Unfitneſs to judge of my Book is, to deſire that the Reader will compare its Title with the Judgment which the Doctor has already publiſh'd of the Newtonian Philoſophy, *which is this:*

'*That* HE *to whom we are indebted for the* 'Newtonian Philoſophy, *has done Mankind a* 'greater *Service, and afforded them more Remedies againſt the Inconveniencies of Life, than* 'they *who formed Men into Societies, and guarded* 'ed *thoſe Societies from foreign Violence by For-* 'tifications, *or from inteſtine Irregularities by* 'Laws. *Than they who bleſs'd Mankind by diſ-* 'covering *the Uſe of Corn and Wine. Or than* 'they *who inſtructed the World in Letters, and* 'laid *the Foundations of Learning.*' *And thoſe I think are Mankind's greateſt Benefactors, who have done them the moſt valuable Services, and afforded them the beſt Remedies againſt the Inconveniences of Life; which the Doctor repreſents as very few, when compared with thoſe that ariſe to us from the* Newtonian Philoſophy. *But I ſhall give his Judgment in his own Words,*

for

for they are much Loftier, and more Emphatical than mine; and it is but mincing this Noble Sentiment of the Doctor's, to expreſs it in any Words but his own, which I ſhould not have preſumed to do, but for the Benefit of thoſe who underſtand not the Language in which he wrote. Having enumerated the many and great Advantages that ariſe to us from the Newtonian Philoſophy, *he compares them with the Advantages of ſuch Services as have been done to Mankind by others, in theſe Words.*

Qui ſcriptis primus tabulis compeſcere Cædes,
Furta & adulteria, & perjuræ Crimina fraudis;
Quive vagis populis Circundari mœnibus urbes
Author erat; Cereriſve beavit munere gentes;
Vel qui Curarum Lenimen preſſit ab Uva;
Vel qui Niliaca monſtravit arundine pictos
Conſociare ſonos, oculiſque exponere voces;
Humanam Sortem minus extulit; UTPOTE PAUCA
IN COMMUNE FERENS MISERÆ SOLATIA VITÆ.

It appears from this, how much the Doctor has told the World that they are indebted to that MAN, *to whom they owe the Advantages that ariſe to them from the* Newtonian Philoſophy. *Let us next ſee who this Perſon is, to whom we are in the Doctor's Judgment ſo deeply indebted. And who ſhould this ſame Perſon be, but the Doctor himſelf, tho' he is ſo very modeſt as not to tell us ſo: For tho' the Invention was Sir* Iſaac Newton's, *and tho' the World may eſteem him for his Invention, yet they are not obliged to him for*

the Advantages of it; for he would not have been so Publick-spirited as to have communicated to us this valuable Secret, but like the Sluggard in the Gospel, would have hid his Talent in a Napkin, if Dr. Halley *had not interposed in our Behalf: As Sir* Isaac *himself very honestly acknowledges in his* Preface. Vir Acutissimus & in omni literarum genere eruditissimus *Edmundus Halleius*, &c. AUTHOR FUIT ut horum editionem aggrederer, quippe rogare non destitit &c. The Learned Dr. *Halley* was the AUTHOR of my publishing this Scheme of Philosophy to the World, for he never ceased importuning me, till he obtain'd his Desire, &c.

It is then to the Doctor that we are obliged for the Advantages that arise to us from the Newtonian Philosophy, *since he was the Author of communicating it to us: For what could we have been the better for Mr.* Newton's *Invention, if it had not been publish'd? Nay, we are not only obliged to him for his having been the Cause of Publishing that Philosophy, but also for his having made it the Business of his Life, to cultivate and improve his Gift to Mankind.*

Let any Man compare the Doctor's Interest in the Newtonian Philosophy, *as it appears from what has been said, with the Title of my Book, and see whether they can then believe the Doctor to be a disinterested Judge of my Performance: And as for his Integrity in Judging in that Affair, he has given such a sufficient Specimen of it, in that ridiculous and impudent Praise of the Part which himself acted, as that no Man I think can suspect him of Integrity.*

After

After having ſuggeſted the Reflection of Dr. Halley's *Unfitneſs to Judge of theſe* Remarks, *I am convinced that they who condemned them upon his Authority, will be as ready to accuſe themſelves of Dullneſs, as I was to accuſe myſelf; and that they who did not condemn me upon that Authority, will be as ready to accuſe thoſe who did, as my Friend was to accuſe me for my Raſhneſs.*

Though at firſt the Doctor's Authority was only alledged againſt me, yet in a ſhort Time I found the Report of my Book's Sillineſs, built upon the Authority of ſome others; for tho' the Doctor's ſuperior Intereſt and Concern made him engage firſt, and moſt ſtrenuouſly in the Affair, it was not to be imagined that ſome other great Men, who were concerned as well as he, would leave him deſtitute of Aſſiſtance; for they have paid their Tribute of Praiſe to that Excellent Philoſophy, as well as he: And it is only to be attributed to the Doctor's ſuperior Genius, and more near Concern, that his Encomium is more Lofty than their's; ſince every One has commended according to his Ability, and not the Merit of the Thing, as well as the Doctor; and not only commended, but cultivated and improv'd it, and every Way engag'd themſelves in its Defence, tho' not ſo deeply as he, yet in Proportion to their Abilities; and it is not to be queſtion'd but their Endeavours in oppoſing my Remarks, *would bear the ſame Proportion to thoſe of the Doctor; and I muſt own that their Judgments of my Performance, are leſs to be ſuſpected than his in that Proportion alſo: For it were unfair to ſuſpect them of exerting themſelves againſt me beyond their Abilities.*

I continu'd to importune my Acquaintances to enquire if any Body had any Thing to allege against me beſide Authority; but for a long Time they could hear of no particular Fault in my Reaſoning, pointed at by any Man: For they who oppoſed me, were very cautious of propoſing any Objections, eſpecially to ſuch as they had any Reaſon to think were enquiring upon my Account, leſt they ſhould afford me an Opportunity of ſhewing the World how little they had to ſay for themſelves, by expoſing the Weakneſs of thoſe Objections: So that I almoſt deſpaired of ever hearing what were my Errors, till I at laſt thought of the following Expedient.

I knew that one Mr. Williams at that Time Lectur'd to the Mathematical Club, upon the Subject of Newton's Principia, and happen'd in Courſe to be upon thoſe Propoſitions in the Beginning of the Firſt Book, againſt which I object. This I imagin'd would lay an Obligation upon that Gentleman, not to decline giving ſome other Reaſon than Authority for condemning as he did my Remarks. I prevail'd with a Member of that Club to read my Book, and put the Queſtion to Mr. Williams, who anſwer'd as every Body did, that it was ſilly; and that there was nothing at all in it. But he who enquir'd, knowing better, would not be ſatisfy'd with this Anſwer; and deſir'd Mr. Williams to point out the particular Faults which he found in it. He then pointed at my Firſt Objection againſt Sir Iſaac Newton's 2d Prop. B. 1. where I ſhow that Two, or any other Number of Forces, None of which are Centripetal, may produce the Curve in Queſtion; tho' he pretends to Demonſtrate that it muſt be a Centripetal

tripetal Force which produces that Effect: And from thence afterwards takes it for granted, that it muſt be the Attraction of the Body in the Center. This Objection, Mr. Williams *ſaid was very unjuſt, ſince Sir* Iſaac *affirmed nothing of Attraction; but that for any Thing he had ſaid, it might be an Angel that carry'd about the Stars, and kept them in their Orbits.*

The plain Injuſtice of this Objection, I do not impute to any Deſign of injuring me, becauſe I ſee in the Objection it ſelf, the real Miſtake of him who made it; for the Centripetal Force, of which Sir Iſaac *ſpeaks in his ſecond Propoſition, Book* 1. *ſeems to be only a mathematical Force, or abſtract Quantity of Force, not a real or Phyſical one: So that if he had not apply'd this Propoſition to the proving in Phyſicks a real Centripetal Force, my Argument had been unfair; and beſide, Sir* Iſaac *does not in this place affirm any Thing of Attraction: So that if my Objection were againſt that Propoſition as it lay, it were highly unjuſt, as Mr.* Williams *imagined it to be. And tho' I do not make the Objection againſt that Propoſition as it is in it ſelf, but as it is applied in the Third Book. So that the Objection as it is made is certainly juſt, yet I ſuppoſe Mr.* Williams *did not ſee how juſt it was againſt the Propoſition as there applied, becauſe he had not (it ſeems) in the Courſe of his Studies, ſurmounted the Two firſt Books and come at the Third, and ſo knew not how Sir* Iſaac *makes uſe of that Propoſition, in proving the firſt three Propoſitions of his Third Book: for if he had come the Length of theſe three Propoſitions, or of the firſt* Cor. Prop. 5.

B. 3. *where Sir* Iſaac *takes it for granted, that his Centripetal Force is the Attraction of the Body in the Center, even ſuch an Attraction as is performed by the Action of that Body; and from this his Suppeſition, by the Law of Action and Reaction, proves, that the moving Body alſo attracts the Body in the Center, without pretending to ſhow any Phænomenon of this laſt Attraction; but founding his Demonſtration of it upon his own Suppoſition. And from that Demonſtration alſo deducing an univerſal Attraction in the following Corollaries and Propoſitions, altogether without* Phænomena. *If (I ſay)* Mr. Williams *had come this Length in* Newton's Principia, *I perſuade my ſelf that he would not have made ſuch an Objection.*

My Friend not being ſatisfied with this Objection, beg'd of Mr. Williams *to conſider the Matter a little better, and to meet with me and ſhew me my Faults more fully, which* Mr. Williams *undertook to do; but ſaid, that it would be fitteſt to put theſe Faults in Writing, and that an Interview betwixt him and me would perhaps not ſo well anſwer the End. This Propoſal my Friend very gladly embraced, knowing that above all Things, I wanted to have the Objections that were made againſt me, in Writing, and came immediately and told me what a conſiderable Point he had gained, in getting a Promiſe of that Nature; but I was not ſo fond of the Promiſe as he; and told him plainly, that tho' by* Mr. Williams's *way of promiſing I knew him to be ſincere, yet I would lay any Odds, that he ſhould not perform, when upon trial he underſtood a little better the nature of the Task which he had taken in Hand. And ſo it hap-*

happen'd, for my Friend could never get any of those written Objections, nor any more by Word from him since.

The same Person who enquired of Mr. Williams, *enquired also of* Mr. Cun, *a Member of the same Club, what were the Faults of these* Remarks, *and for a long time could get no Answer; but at last, all of a sudden,* Mr. Cun *desired my Friend to bring me to the Club, and he would disprove my whole Book; but I happen'd at that Time not to be in the way; so that my Friend was obliged to stand the Brunt of these mighty Objections, which were as follows.*

His first Objection was against my Third Theorem. He pointed out no Faults in my Reasoning, but endeavour'd to prove the contrary thus. He observed, that I acknowledged the Efficacy of a Virtue spread every way to or from a Center equally, to be upon Surfaces, as the Squares of the Distances; he supposed Solids to consist of an infinite Number of Surfaces: And so from my Concession, and his own Supposition, he very rightly inferred, that the Efficacy of such a Virtue acting upon Solids, must be in the same Proportion to the Distances, as acting upon Surfaces. He might as well have supposed Surfaces to be made up of Lines; and then he might in the same manner have proved the Efficacy of such a Virtue, when acting either upon Surfaces or Solids, to be in proportion to their Distances.

Mr. Cun *should have known that the Word Line in Mathematicks, expresses not any real Being, but only an Idea of Length, abstracting from Breadth and Thickness; and also that the Word Surface expresses only the Idea of Length and*

Breadth,

Breadth, abſtracting from Thickneſs: it being certain that theſe Words can expreſs no more than Ideas, ſince the Things they do expreſs cannot exiſt; for Length without Breadth and Thickneſs, or Length and Breadth without Thickneſs, which are expreſs'd by theſe Words, cannot exiſt; becauſe wherever any one of theſe Dimenſions are, there they all Three muſt neceſſarily be; but they can be ſeparately conſidered, and our Conceptions or Ideas of them, is all that the Words Line and Surface expreſs; but the three Dimenſions together, which are expreſs'd by the word Solid, have a real Exiſtence in Nature, ſo that the word Solid expreſſes a real Being: And when in the Mathematical way we ſpeak of any Thing acting upon Lines or Surfaces, we do not mean that it acts upon our Ideas, but that it acts upon Solids, as they are extended in Length only, or as they are extended in Length and Breadth only: And when we ſay, that it acts upon the whole ſolid Content, we mean, that it acts upon Solids, as they are every way extended in Length, Breadth, and Thickneſs. All this, I ſay, Mr. Cun *ſhould have known; and if he had known a Surface to be an Idea only, he muſt alſo have known that it would require more Arithmetick than he is Maſter of, to find out how many Ideas go to make up a ſolid Body.*

But tho' Mr. Cun *had not known whether the Word Surface in Mathematicks expreſs'd a real Being, or an Idea only, as in Truth our vulgar Mathematicians do not; and* Mr. Cun's *Education gives no room to expect any thing extraordinary from him; yet if he is not more ignorant than the common Profeſſors of Mathematicks, he muſt*

must know thus much, that whatever it be that is expreſs'd by the Word Surface, it has no Thickneſs; for if Thickneſs be added, tho' in ever ſo ſmall Quantity, to the Length and Breadth, which every Body knows to be expreſs'd by that Word, it has trine Dimenſion and becomes a Solid. So that if Mr. Cun *knew but thus much of the Matter, he muſt alſo have known, that No-thickneſſes added together, would not make up Thickneſs; and that even the Word Infinite, which is ſo often uſeful to thoſe who either underſtand not what they ſay, or want not to be underſtood, could here do him no Service; for thoſe who think fit to talk of infinite Numbers and Quantities, allow that an infinite Number of Nothings will not make up Something.*

Mr. Cun *objected alſo againſt my fourth Theorem, where I demonſtrate, that if the Tides be raiſed by the Moon's Attraction, the Tide under her* Ceteris Paribus *muſt be higher than that on the other Hemiſphere. He ſaid nothing againſt my Reaſoning, nor endeavoured to make appear, that Sir* Iſaac Newton, *or* Dr. Gregory, *have ſhewed any imparity ſufficient to account for the Equality of the Tides; but he fell upon a Method of his own inventing, to account for this Equality. For whereas theſe Authors, in accounting for the Tides from the Moon's Attraction, conceive the Earth to be at reſt, as it really is in reſpect of the Moon;* Mr. Cun *ſuppoſes the Earth to be moving towards the Moon.* 'When 'the Earth (ſays he) falls from Tangents to-'wards the Moon, all the Parts of the dry Land 'being connected together, muſt move towards her 'with equal Velocity; but the Waters being 'Fluid,

'Fluid, that Part of them which is under the 'Moon, and is more attracted by her than the 'whole Body of the Earth taken together, as be- 'ing nearer, must move faster toward the Moon 'than the rest of the Earth; and that part of 'the Water which is Diametrically opposite, be- 'ing more distant and less attracted than the 'whole Body of the Earth, must be somewhat 'backward in its approaches to the Moon, which 'must occasion the two Protuberances of Water, 'which we call Tides.

When Mr. Cun was busy, supporting and explaining his Account of the Causes of the Tides, my Friend put him in mind, that it was toward the Sun, and not toward the Moon; that the Earth fell from Tangents; and that if this were the Cause, these Protuberances must always point to and from the Sun, which spoilt Mr. Cun's fine Fancy, and put him quite out of Humour. In short, he was fain to turn into Passion, which is the only way that Men have to keep themselves in Countenance when they are catch'd in such gross Blunders; and was so highly offended, that he could not be prevailed with to point out any more of my Faults at that Time, nor to condescend to meet with me to do so at any other Time, tho' he said he could easily disprove all my Book, if it were worth his while.

I am at a Loss in judging from Mr. Cun's Objections, whether they proceeded from Ignorance or Design; but thus much appears from his Conduct, that he is very strenuous in opposing my Remarks, tho' he has nothing to say against them; and since he appears to be no ways interested in the Newtonian Philosophy himself, as having no Reputa-

Reputation that way, I muſt take the Freedom to tell him, if he knows it not, that he is only a Tool in the Hands of Men of Reputation, made uſe of by them to hand about among ignorant People, ſuch Objections as they could not themſelves own, without injuring their Reputation. And I ſee by this, by the written Objections which were ſhewed to Mr. Græme *at* Edinburgh, *and by ſome other Stories of that nature, which for brevity I omit, that tho' thoſe who condemn me will not give their Reaſons for ſo doing in print, nor let me hear of them any other way, yet they take Care to hand about ſome Objections to be propoſed to proper Perſons, which is highly unjuſt; for if theſe* Remarks *deſerve no Anſwer, why ſhould any Anſwer be given? And why ſhould not every Man be left to himſelf in judging? Or if it be worth while to make any Anſwer, or propoſe any Objections againſt me, why is it not done in the ſame open manner in which I have propoſed my Objections againſt the* Newtonian *Philoſophy? that I may have the Privilege of canvaſſing their Objections againſt me, as they have the Privilege of canvaſſing my Objections againſt them.*

This Management is not only unjuſt, but the moſt hurtful to me of any; for tho' in theſe Remarks *I have pointed out the chief Errors of the Reaſoning that ſupports the* Newtonian *Philoſophy, yet I have not endeavoured to diſcover to the World ſuch of their Miſtakes as have made thoſe Errors inſenſible to them: And ſince they lie under thoſe Miſtakes ſtill, it is eaſy to frame Objections againſt my Arguments, whoſe Defects may by theſe ſame Miſtakes be covered from View,*

and by keeping up ſuch Objections from me, to hinder their Weakneſs from being expoſed, and get them to paſs currant.

I had ſeveral Reaſons for not undertaking to diſcover to the World ſuch of their Miſtakes as have made the Errors of the Newtonian *Philoſophy inſenſible to them, but the chief was this; I ſaw that the doing ſo would bear very hard upon the Eſteem that Men have for the Abetters of that Philoſophy, whoſe Reputation I was not willing to attack any farther than was needful, in order to diſabuſe the World of thoſe groſs Errors in Phyſicks, into which theſe Men have led them; and I reflected, that if by ſheltering unjuſt Objections againſt me under theſe Miſtakes, they obliged me to ſhew them, I ſhould have the ſolid Excuſe of Self-Defence for what I did that way.*

Notwithſtanding my Care not to give theſe Men any juſt ground of Offence, they are as much offended as if I had done them a great Injury, and accuſe me for daring to make ſo bold as I have done, with the Character of ſo great a Man as Sir Iſaac Newton. *If I had in the ſame manner made bold to charge* Ariſtotle, Plato, Epicurus, *and all the great Men who have propoſed Schemes of Philoſophy to the World, I ſhould not have been charged with too much boldneſs.*

——Nulli gravis eſt percuſſus Achilles.
Pone Tigellinum. ——— —— *Juv.*

And yet I am perſuaded that any of the Admirers of Sir Iſaac Newton, *who are furniſhed with a tolerable Stock of Modeſty, will hardly ven-*

venture to prefer him to all thoſe great Men; ſo that it is not the Reaſon of the Thing that makes them accuſe me for uſing too much freedom with him, or that there is any more ground for looking upon his Perſon or Philoſophy to be ſacred, than theirs. But this Charge proceeds only from the Reſentment which ariſes from their being intereſted in him and his Philoſophy.

Thoſe Men, I know, will think nothing good Manners to them and their Philoſophy, but ſuch an implicit Submiſſion, and ſuch fulſome Praiſes as they are accuſtomed to; and therefore it is in vain for me to endeavour ſatisfying them in that Point: ſo that without any farther regard to them, I ſhall give the Reader an Inſtance or two of ſuch common Miſtakes as have made the Errors of the Newtonian *Philoſophy inſenſible to the World, which will, I hope, not only cut off all Objections that lean upon theſe Miſtakes, but make all others ſuſpected which are not propoſed in ſuch a manner as that I have the Freedom of examining their Sufficiency.*

Firſt then, Men are ready to miſtake Mathematical for real or phyſical Quantities; the Difference betwixt which I ſhall endeavour to ſhew by a familiar Example. If two Horſes, pulling in different Directions, draw a Stone; the Force that is actually impreſſed upon the Stone by each of the Horſes, is a phyſical Quantity; that is to ſay, a Thing that really is, or has an actual Being in Nature. But if a Mathematician takes theſe two Forces under his Conſideration, he will compound them into one Force, directed as the Diagonal of a Paralelogram, in the Direction of

whoſe Sides the Horſes pull; or he will diſſolve thoſe Forces into Four, or into any Number of Forces he pleaſes: and theſe compound and diſſolved Forces are Mathematical Quantities; that is to ſay, Ideas only, or Things that have no real Being in Nature, any where, but in the Mind of him who conceives them.

It's plain, that theſe Mathematical Forces are not real ones; for if a real Force were impreſs'd upon the Stone, in the Direction of the Diagonal, that is, if the Mathematicians compound Force were a real one, the Stone muſt move twice ſo faſt as it does by the Addition of this Force, to the Forces of the two Pulls of the Horſes. Neither can it be ſaid that theſe Two and that One are the ſame; for certainly two Pulls are different from but One, and a Pull in one Direction is in it ſelf different from a Pull in another Direction: Their Quantities alſo differ as the Length of the two Sides of a Paralelogram differs from the Length of its Diagonal. In ſhort, theſe Forces agree in nothing, but that they produce like Motions; and it's for that Reaſon, that a Mathematician (whoſe Buſineſs is from the Quantity of a Force given to determine the Quantity of the Motion which that Force muſt produce) takes them for the ſame; becauſe they are of the ſame Value to him in his way. But tho' theſe Forces which are in themſelves very different, be alike to a Mathematician for his Purpoſes, it muſt ſeem as ridiculous to a Man that underſtands Natural Philoſophy, to ſee a Mathematican taking thoſe Forces for the ſame Thing in Phyſicks, as it would do to a Mathematician to hear a Porter affirming,

that

that a Globe and a Cube of equal Weight were the ſame in Mathematicks, becauſe they are the ſame to him in his way of Buſineſs.

It's ſtrange that our Mathematicians, when they compound and divide Forces with ſuch Eaſe, do not reflect that real Beings are more untoward, than to allow themſelves to be thus chopped and changed; and that they are doing nothing all the while, but turning and winding their own Ideas: And it's odd that they cannot find out that the real Forces of Nature ſuffer no Alteration in their Beings or Modifications, by their Way of Compounding and dividing them.

This Miſtake of taking Mathematical for Phyſical Quantities, is One of thoſe many Miſtakes which have made the Errors of the Newtonian Philoſophy *go down ſo well with the World: To ſhew which, I ſhall alſo give an Inſtance of One Error in that Philoſophy, which is ſhelter'd under this Miſtake. Sir* Iſaac Newton, *in the firſt Three Propoſitions of his Third Book, employs a Centripetal Force, to turn from ſtreight Lines all the Planets, and keep them in their Orbits; which Work I think muſt require a Real Force: But Sir* Iſaac's *Force is not ſuch, but a Mathematical or Compound Force only, as appears from the* 2d Prop. Book 1. *and leaſt any Man ſhould not from that Propoſition it ſelf have diſcern'd what ſort of Force this is, Sir* Iſaac *adds a Scholium to his Propoſition, on Purpoſe to tell them that the Force in the Propoſition is a Compound Force.*

I know not whether the Brevity which I am confined to, has allow'd me to explain this Miſtake, and ſhew the Error that depends upon it,

ſo as to make them evident to every Capacity; but I am inclin'd to believe that moſt Men of Learning will underſtand me; and to All ſuch as do, Sir Iſaac Newton *and his Party, in Spite of their great Reputation, muſt appear to be of that Rank of Mathematicians, who tho' they can talk of Lines, Surfaces, Forces, and other Mathematical Quantities, ſo as to anſwer many uſeful Ends, yet know not what they ſpeak of, and cannot tell whether thoſe Things which are ſo familiar to them, have any Being in Nature: And notwithſtanding their Reputation for having ſo highly improv'd Phyſicks by the Help of Mathematicks, muſt appear not to have ſo much as known what theſe Sciences were, ſince they could not diſtinguiſh the Subject of the One from the Subject of the Other. Sir* Iſaac Newton, *I ſay, and his Followers, muſt appear to All thoſe who underſtand the Difference betwixt Mathematical and Phyſical Quantities thus Ignorant, in Spite of their Reputation; or elſe to have had a Deſign of propoſing and commending to Men a Syſtem of the World, modell'd by their Ideas only, and govern'd by a Cauſe which they underſtood to have no Exiſtence, ſave in their own Imagination: And this is ſo hard a Dilemma, that I was loath in my* Remarks *to reduce them to it, by explaining the Matter fully. And that it may appear that it was this, and not Diffidence of the Soundneſs of what I have now ſaid, which made me not ſay it in the* Remarks, *I promiſe that if any Man can by a good Argument clear them of that Dilemma, I ſhall for the Sake of that One Argument renounce theſe* Remarks, *and believe every Thing*

that

that he who propoſes the Argument pleaſes to affirm in any Subject.

I ſhall only ſtay to inſtance One Miſtake more, which All they who have embrac'd the Newtonian Philoſophy *lie under.* Sir Iſaac Newton *and Dr.* Gregory *do in their Way demonſtrate, that the Attraction of the Sun upon the Earth, cauſes the Earth to deſcribe round the Sun an Elipſis and Areas proportionable to the Times, to Mathematical Exactneſs; and that the ſame Attraction of the Sun upon the Moon, which according to them is an equal accelerating Force, muſt cauſe the Moon to accompany the Earth in its Orbit, to the ſame Exactneſs; while the Earth's Attraction makes the Moon alſo deſcribe round it an Elipſis and Areas proportionable to the Times alſo to like Exactneſs: So that at this Rate, the Attractions of the Sun and Earth upon the Moon, are ſufficient to Mathematical Exactneſs for producing the Moon's Motion, if it were abſolutely regular: Or which is all one, the adequate Effect of theſe Two Attractions upon the Moon, is the Moon's Motion, if it were regular; but it is far from being ſuch; and therefore the Queſtion with our Philoſophers was, to find out the Cauſe of theſe Irregularities, and what ſhould they take for this Uſe but the Attraction of the Sun? That is to ſay, Take the Cauſe whoſe adequate Effect is to produce the regular Motion, and employ it to diſturb its own adequate Effect. It was no leſs than Neceſſity that forc'd our Philoſophers to make ſo hard a ſhift for a Cauſe to produce the Moon's Irregularities: For ſince they keep Time with her Situations in Reſpect of the*

Sun,

un, if they had taken them from any other Cauſe, the Phænomena *would have cry'd aloud againſt them. I know not how to ſet this Miſtake in a better Light, than by telling a Story of a Miſtake of the ſame Nature, in a familiar Caſe.*

They tell of an Iriſhman, *(for true or falſe, ſuch Stories are told of them) that when he came to Town, he went to a* Corn-chandler's *to buy Oats for his Horſe, but forgot to carry ſomething to put them in, and was obliged to take his Hat for that Uſe. After it was full to the Brim, there remained ſtill ſome Oats in the Meaſure, and the* Chandler *ask'd him in what he would put the reſt; He very readily bethought himſelf that his Hat could carry Oats upon the one Side as well as upon the other, and turn'd up the other Side of his Hat to hold the reſt, without reflecting that by his ſo doing, he muſt ſpill the Oats that were already put in.*

Sir IſaacNewton's *Miſtake (if it was not Deſign) in employing the Sun's Attraction upon the Moon to produce more than its adequate Effect, is the very ſame with the* Iriſhman's, *in putting more Oats in his Hat than its Fill: And yet upon this groſs Miſtake the ſo much admir'd* Theory *of the Moon's Motion is built, of which Miſtake the Reader will eaſily diſcern that I ſhun'd to ſpeak in the* Remarks.

I have now, Reader, ſaid what I thought neceſſary for guarding you againſt the indirect Management of thoſe who oppoſe my Remarks; *I muſt beg your Patience yet a little, till I make ſome few Reflections upon the whole Matter.*

Tho' any Man who has the leaſt Taſte of Natural Philoſophy or Mathematicks, is in ſome Meaſure able to judge of theſe Remarks, *yet no Man is able ſo abſolutely to judge in the Matter, as that he can oppoſe his Judgment to the Judgments of all thoſe famous Men who declare againſt them; unleſs he can enter fully into the Subject, and ſearch my Arguments, and thoſe againſt which I object, to the Bottom; which he cannot do, without a good Taſte of Natural Philoſophy, Skill in Mathematicks, and a perfect Knowledge of* Newton's Principia, *his Dialect and Way of thinking; which Qualifications meet but in a few, who are generally intereſted againſt me. In ſhort, the Scarcity of thoſe who are conſcious of being capable to judge for themſelves, is what makes ſo many take all upon Truſt, and conſequently condemn me; whereas, had the Subject been generally underſtood, the Evidence of theſe* Remarks *is ſuch, that it would have been impoſſible to ſupport the* Newtonian Philoſophy *againſt them in the Eyes of the World.*

The Scarcity then of People capable to judge in the Matter, is what expoſes me ſo much to the Laſh of the Authority of thoſe who are intereſted againſt me. And for this Evil, I hope, I have now found a Remedy; for I ſhall ſhew every Reader of whatever Capacity or Knowledge he be, how he may ſafely judge in the Affair.

Firſt then, the Conduct or thoſe who oppoſe me ſhews, that their Oppoſition proceeds from ſomething elſe than Contempt of my Arguments, which is pretended; for if my Arguments be ſilly, Why ſhould ſo much Pains be taken to hinder the World from

ſeeing

ſeeing them, as appears in the above Narration to have been taken for that End? Or if they be worth ſo much Trouble as theſe Managements muſt have coſt, How can they be unworthy the much leſs Trouble of an Anſwer? Nay, if my Reaſonings be ſo groſſly ſilly as is pretended, How comes it to paſs that not only None of my Acquaintances can ſee it, but that None of thoſe who pretend to ſee it, can be prevail'd with to point it out: Or rather, Why do they who endeavour to ſhew my Errors, ſhew their own groſs Blunders inſtead of them? But why ſhould I inſiſt upon a Point which is ſo plain; for certainly, without my ſaying any more upon the Head, no Man that believes the Facts which I have narrated, can hinder himſelf from ſeeing whence the Management proceeded. And no Man can in Juſtice queſtion the Truth of theſe Facts, becauſe as far as was needful or could be done, without injuring particular Perſons, I have added Names and Circumſtances, which is all the Satisfaction that can be given, or ought to be expected in ſuch Caſes.

But that this may hinder no Man in Judging, I ſhall ſhew another Method perfectly ſure and independent of Matters of Fact, Knowledge of the Subject, or any Thing but Common Senſe, which is this; The Charge that is brought againſt theſe Remarks *is, that they are ſilly and not worth anſwering. Let us then ſee what Sort of Silineſs it is in Objections which are made againſt the Opinions of a Party, that is ſufficient to excuſe Anſwering.*

It's plain, that every Objection which is not perfectly good and ſound, tho' ever ſo plauſible in

Shew

Shew and Appearance, when ſearch'd to the Bottom by Men of ſufficient Penetration for diſcovering its Defects, appears to ſuch to be ſilly, weak, groſs, or to deſerve any of theſe Epithets which open Falſhood deſerves; but it is not enough to excuſe anſwering ſuch an Objection, that Men of deep Reach ſee it to be ſilly; for if thoſe of ordinary Capacity ſee it not, they make up ſo conſiderable a Part of Mankind, that ſuch as do ſee it ought to ſhew it to them alſo; which is anſwering the Objection: So that neither real Sillineſs, that is to ſay, Falſhood of an Objection, nor ſuch Sillineſs as appears to None but Men of a deep Reach, are ſufficient to juſtify not anſwering an Objection, but ſuch Sillineſs only as appears to Men of ordinary Capacities without being ſhewed them; and ſince every Man of ordinary Capacity can judge what does of its own Accord ſufficiently appear to him ſo, every Man of ordinary Capacity can judge whether theſe Remarks *are ſo ſilly as to deſerve no Anſwer; and there being but Two poſſible Reaſons for a Party's not anſwering Objections, that are ſo directly made againſt them as thoſe of mine are,* viz. *either that the Objections are not worth anſwering, or that they are unanſwerable: He who judges that the Former is not the Reaſon of not anſwering my Arguments, muſt judge it to be the Latter.*

I am alſo repreſented to be as ſilly as my Remarks, *and inſulted in a very haughty Manner for being the only Perſon that cannot ſee my own Error; and I muſt do my Opponents the Juſtice, to own that the One is a very neceſſary Conſequence of the Other: For if my* Remarks *be ſo groſſly*

groſſly ſilly as they are ſaid to be, I muſt be the ſillieſt Creature in Human Shape, not only in not being able to find out that which appeared ſo well to all the World, but in continuing now to ſhew my Sillineſs further to the World, and in provoking thoſe alſo to do it, who have ſhew'd ſo much Willingneſs to drop the Subject, and ſo much Regard for my Character, as to put themſelves to a great deal of Trouble in hindering the World from reading my Sillineſs in my Book.

It's plain, I ſay, that if my Remarks *be ſo ſilly as they are repreſented, I muſt be exceeding ſilly; and it is a neceſſary Conſequence of this, that if I am not exceeding ſilly, my* Remarks *are not what they are repreſented to be. Now it's obſervable, that all Imperfections of the Mind, except Sillineſs alone, may be diſguiſed and covered from the Eyes of the World; and that it is the Property of that Imperfection only, that it ſelf is inconſiſtent with its being diſguiſed. And hence it is, that he who is extremely ſilly diſcovers his Sillineſs to all Men of ordinary Capacities equally in every Thing he does, ſays or writes upon whatever Subject, and carries it as conſpicuous about with him, as if it were branded upon his Forehead. And they who underſtand nothing of the Subject of theſe* Remarks *may yet, from what I have ſaid in this* Preface, *upon a Subject that muſt neceſſarily be underſtood by every one that reads any ſort of Books, diſcover my Sillineſs, if I am exceeding ſilly; or if they diſcover no ſuch groſs Sillineſs, may ſafely conclude, that theſe* Remarks *cannot be ſuch.*

When

When these Remarks *were publish'd, some of my Opponents essayed to give a moderate Character of them at first; and said, that I had mistaken Sir* Isaac's *Meaning; and that they did not wonder at it, for they themselves ran into the very same Mistakes, till they fully understood the Subject. There was abundance of Policy in making choice of this Report, for it is a certain Rule of Prudence with those who are obliged to use Falshoods in their own Defence, to make choice of such as are near to Truth; for if the Difference be wide, it the easier appears. Now here was but a very imperceptible Difference betwixt this Falshood and the Truth; for they who made use of this Charge, did in effect own that my Objections were such as might appear just to every one that did not thoroughly understand the Subject; and such Objections have the greatest Resemblance to just ones. And the Advantage of this Report was, that by it every Man was directly cut off from judging in the Matter, but such as perfectly understood the Subject.*

This Report, however advantageous it was in its near Resemblance to Truth, which made it most tenible, yet did not please the Leading Men of the Party; and it was no Wonder; for if that Report had been made Choice of, then why not answer my Remarks? *They saw very well that no moderate Charge against them, nor any Thing less than gross Sillines would excuse answering; and since answering was at any Rate to be avoided, Sillines must be pretended: And as soon as the Word* Silly *came from above, those very Persons, who had given a Moderate Character before,*

changed their Note, and cry'd Silly as fast as any Body.

Tho' of the Two, this was certainly the most advantageous Report for them, yet by excusing themselves thus from answering, they laid themselves open upon the other Side, and were obliged to go so wide of the Truth, as to leave the Difference sensible to Men of ordinary Capacities. Thus it still fares with those who make use of Lyes and Falshood to defend themselves; for there is something so monstruous in the Nature of Falshood, as that it can scarce be every Way hid, but may be made appear upon some Side or other.

I have shew'd you, Reader, whoever you be, of whatever Degree of Knowledge or Capacity, how to judge safely of these Remarks. I now beg of such of you as have any Value for the excellent Science of Nature, to assist me in rescuing her from the Hands of those Men, who have for a great while kept her Captive, and barr'd all Access to her, by amusing the World with Fiction instead of her. I intreat also of such of you, as have any Regard for the useful Science of Mathematicks, that you will join in clearing that Virgin Science of Errors and Sophistry, with which she is now defiled, by a Set of Men, who have prostituted her intire Character of Veracity, for passing upon the World their gross Fictions instead of Philosophy; which nothing less than the Credit of Mathematical Demonstrations could have made Men swallow. And lastly, I beg of such of you, as value Truth as such in Opposition to Error, whether you have any Regard for these Sciences or not, and

and who would not chooſe to deliver up unguarded Innocence into the Hands of Calumny and Oppreſſion, or the World to be abuſed by deſigning Men; of which laſt Sort, I hope all Readers are; to aſſiſt me in vindicating the Cauſe of Truth and my own Innocence, in ſhewing the World how they are abuſed: What I intreat is, that you will not ſuſpend your Judgment; for as Matters ſtand, that is equivalent to your condemning me; but ſince I have ſhewed every Man how he may ſafely judge, I beg of all of you to judge poſitively in the Matter, as it appears to you. And I muſt give you this further Caution in judging, that if you ſhould happen to Err, as I perſwade myſelf after what is ſaid you will not, yet remember how much more ſafe it is for you to Err on the one Side than on the other: For if either by ſuſpending your Judgment or pronouncing againſt me, you condemn me unjuſtly, you ſacrifice thoſe Two excellent Sciences to Error, Truth to Falſhood, Innocence to Calumny, and the World to be abuſed by deſigning Men: Whereas if you Err in acquitting me of the heavy Charge that is brought againſt me, you do no more Harm, than to oblige thoſe who have been at ſo much Pains already about the Newtonian Philoſophy, *to be at the inconſiderable Trouble of anſwering a few weak Objections.*

REMARKS

UPON THE

Newtonian Philoſophy.

THERE is nothing to which the Philoſophers of all Ages have ſo generally applied themſelves, as to the Study of Nature; and there is no Study in which they have been able to make ſo little Progreſs as in this; eſpecially in that Part of it which is employ'd in diſcovering the Cauſes of the beautiful Order and ſteady Motions of the Sun, Moon and Stars: And if we conſider their Schemes of this Part of Natural Philoſophy, we ſhall find them All built either upon groſs Abſurdities, or Words without Meaning;

ing; and evidently ſee that Human Underſtanding, even in its greateſt Perfection, is very unequal to ſo hard a Task as the ſearching out this myſterious Cauſe.

Our Philoſophers have now got into a Way of treating that Part of Natural Philoſophy in the ſame Method with Mathematicks; and by this Management, propoſe to make it more certain than formerly, and to get Mathematical Demonſtration to determine this Point, which has deceived ſo many of their Predeceſſors. It is moſt certain that Mathematicks give very great Aſſiſtance to Natural Philoſophy; but I cannot ſee the Advantage of handling Natural Philoſophy it ſelf, in the ſame Method as Mathematicks; and am inclined to believe, that our Modern Philoſophers have made uſe of the Mathematical Way, rather becauſe the Study of Mathematicks (to which they were moſt accuſtomed) had made that Method moſt eaſy and familiar to them, than for

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any real Advantage there is in handling Natural Philoſophy in ſuch a Manner. For though it be true that the Thing which is moſt wanted in Natural Philoſophy, is to make its Propoſitions more certain, and that the Proofs of Mathematicks are of all others the moſt certain; yet this Certainty in the Proofs of Mathematical Propoſitions, ariſes from the Nature of the Subject of that Science, and not from its Method. For it is becauſe we have clearer Ideas of the Relations of Quantities, the Subject of Mathematicks, than of the poſitive Properties of real Beings, the Subject of Natural Philoſophy, that the Propoſitions of the former Science can be proved more clearly than thoſe of the latter; and not becauſe in the one Science we have a better Method of propoſing our Reaſons, than in the other. It's true, the Method of proving Mathematical Propoſitions, is the fitteſt for ſhewing ſuch an evident Chain of Connexion as thoſe

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Propoſitions have with the cleareſt Principles, becauſe there is no more to be done, but in a plain eaſy Manner to expreſs this Connexion, which when barely propos'd, ſhines by its own Light: But there is ſo little Evidence in many of the Principles upon which Natural Philoſophy depends, and the Chain of Connexion is ſo dark, that methinks no Man ſhould attempt to ſhew it in the ſame eaſy and peremptory Method with Mathematical Demonſtrations; and in my Opinion, the Mathematical Method, inſtead of being an Advantage to Natural Philoſophy, is as unfit for it, as for the Diſputes of the Bar, or thoſe of the Cabinet-Councils of Princes.

But whatever Advantage or Diſadvantage there be in this Method of handling Natural Philoſophy, and of proving its Propoſitions, yet theſe Proofs can never be Mathematical Demonſtrations; nor can they be made better by any Method, than their own Nature, and the Nature of

of their Subject will allow. So that notwithſtanding our Modern Natural Philoſophy is propoſed to the World in a Mathematical Dreſs, it is Natural Philoſophy ſtill, and not Mathematicks. It is that ſame Science which has ſo often deceived the greateſt Philoſophers, in which the greateſt of Men have been often convicted, and are ſtill to be ſuſpected of Errors; and not that Science, in which any Man of common Senſe is capable to force the Aſſent of the moſt ſtubborn and ſubtil Diſputant. So that I ſee no Reaſon why the Dreſs of this Philoſophy ſhould cauſe Men to ſtand ſo much in Awe to examine its Sufficiencies as they do.

The Account we have of the new found Cauſe, which, according to this new Philoſophy, keeps the whole Syſtem of the Univerſe in Order, makes that Philoſophy to me ſeem much to be ſuſpected. The famous Sir *Iſaac Newton*, its Author,

tells us, * That it is a Virtue or Power which Bodies have to attract or draw one another; that every Particle of Matter has this Power or Virtue; that it reaches to all Places at all Diſtances, and penetrates to the Center of the Sun and Planets; that it acts not upon the Surfaces of Bodies as other Natural Agents, but upon their whole Subſtance or ſolid Content, *&c.* and if ſo, what a ſtrange Thing muſt it be.

I confeſs that the many Inſtances of unintelligible Cauſes that have been aſſigned by the greateſt Philoſophers for the Production of thoſe ſurprizing Phænomena of the Motions of the Heavens, make me ſuſpect this Cauſe, which looks as monſtrous as any of the Fictions of Antiquity; and the Mathematical Dreſs of the Arguments which ſupport that Cauſe, does not hinder me from ſuſpecting their Sufficiency: And I perſwade my ſelf, that my *Re-*

* *Page* ult. *Prin. Math. and elſewhere.*

marks

marks upon thoſe Arguments will neither be uſeleſs nor diſagreeable to the Learned World.

The Chief Perſons who have propos'd to the World this Scheme of Phyſicks, and the Reaſons that ſupport it are, Sir *Iſaac Newton*, in his *Principia Philoſophiæ*, and Dr. *Gregory*, in his *Principia Aſtronomiæ Phiſicæ*, &c. and to avoid Confuſion, I ſhall take theſe Reaſons from thoſe Authors only.

Mr. *Newton*, L. 3. Prop. 1. aſſerts of the *Satellites* of *Jupiter* and *Saturn*, that they are hindred from moving in ſtreight Lines, (which Bodies naturally affect) and kept in their Orbits, by a Force directed to *Jupiter* and *Saturn*. Prop. 2. He aſſerts of all the Primary Planets, that they are hindred from running out in ſtreight Lines, and kept in their Orbits, by a Force directed to the Sun. And Prop. 3. He aſſerts of the Moon, that ſhe is kept in her Orbit by a Force directed to the

Earth; and for Proof of theſe Three Aſſertions, refers to his Account of the *Phænomena* of the Motions of thoſe Bodies, and to his 2d and 3d Prop. of his 1ſt Book.

The *Phænomena* to which he refers are, that the *Satellites* of *Jupiter* and *Saturn* appear to move ſo, round *Jupiter* and *Saturn*, the Primary Planets round the Sun, and the Moon round the Earth, as to deſcribe round them Areas proportionable to the Times; by which he means that the Areas comprehended within any Parts of the Curve which thoſe Bodies deſcribe, and Lines drawn from both Ends of thoſe Parts to that Body round which they move, are as the Times in which the Body did deſcribe thoſe Parts of the Curve.

It may be very true that the *Satellites* of *Jupiter* and *Saturn* deſcribe round *Jupiter* and *Saturn*, the Primary Planets round the Sun, and the Moon round the Earth, Areas proportionable to the Times; but this

this neither does nor can appear to any great Exactneſs from Obſervation, at leaſt if order'd by Rules independent of Mr. *Newton*'s Philoſophy; and to infer from Rules depending upon that Philoſophy, that the Planets deſcribe ſuch Curves, and from their deſcribing ſuch Curves again to prove that Philoſophy, is not fair Reaſoning. Nay, according to Mr. *Newton* himſelf, it cannot appear that theſe Bodies deſcribe ſuch Curves, becauſe by the Proſecution of his Subject, he is forced * afterwards to affirm of all the Planets, particularly of *Jupiter*, *Saturn*, and the Earth, that they do not move in that Manner. Notwithſtanding, I ſhall not inſiſt upon this; but ſuppoſe that the Planets appear to move as Mr. *Newton* ſays.

In the 2d and 3d Prop. of his 1ſt Book, he aſſerts, that all Bodies moving in any Curve, which in a Plan deſcribes round any other Bo-

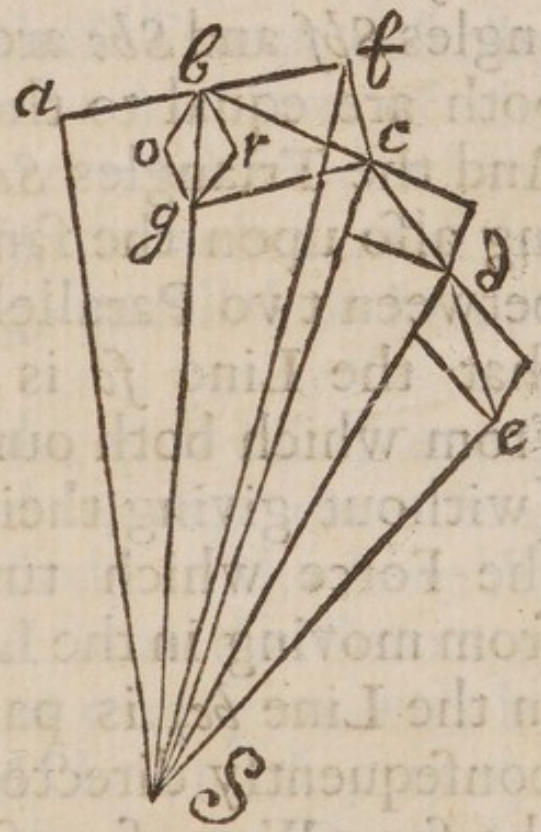
* *Prop.* 13. *L.* 3. Prin.

dy (whether in Motion or at Reſt,) Areas proportionable to the Times, are forced into ſuch a Curve by a Force directed to that Body, round which they deſcribe thoſe Areas. Dr. *Gregory*, in aſſerting the ſame Thing, propoſes the Caſe of the Body round which the other revolves being in Motion, and the Caſe of its being at Reſt, ſeperately, and ſo ſets this Matter in a clearer Light; whoſe Method I ſhall follow, and take firſt the Caſe of that Body being at Reſt, as he does.

The Demonſtration of Mr. *Newton*'s 2d Prop. Book 1. and Dr. *Gregory*'s 12th Prop. Book 1. where theſe Authors demonſtrate this Caſe, are in Effect the ſame; but Dr. *Gregory* proves it more fully, and I ſhall repeat the Demonſtration of this, ſo as to comprehend what they both ſay: For it is needleſs ſeperately to repeat their Demonſtrations, where they differ in nothing, but that the one is more full and clear than the other. And this Method of repeating

ing their Arguments, I ſhall obſerve all along. The Demonſtration of Mr. *Newton*'s 2d, and Dr. *Gregory*'s 12th Prop. is as follows:

Let the moving Body move in the Line *a b c d e*. Divide this Line into ſuch Parts *ab*, *bc*, *cd*, *de*, as the Body deſcribes in equal Times. Let the Body at Reſt be *S*, draw *bf* = *ab*, draw *aS*, *bS*, *fS*, *cS*, *dS*, *eS*. The Body in any certain Time deſcribing the Line *ab*, would if nothing hinder it, deſcribe in equal Time *bf* = *ab*, by the Nature of Bodies in Motion: And ſince it deſcribes not *bf* but *bc*, it is turned from moving in *bf* by ſome Force. Suppoſe by the centripetal Force *bg*. The Triangles *Sbf* and *Sab* are



are equal, becauſe their Baſes *ab* and *bf* are equal, and their Altitude is the ſame; the Triangles *Sbc* and *Sba* are equal, becauſe they are the Areas deſcribed in the equal Times *ab* and *bc*, and the Areas are *Ex Hypotheſi* as the Times; but the Triangles *Sbf* and *Sbc* are equal, becauſe both are equal to the Triangle *Sab*. And the Triangles *Sbf* and *Sbc*, being alſo upon the ſame Baſe, *Sb* are between two Parallels *Sb* and *fc*; ſo that the Line *fc* is parallel to *Sb*. From which both our Authors infer, (without giving their Reaſon) that the Force which turned the Body from moving in the Line *bf*, to move in the Line *bc*, is parallel to *cf*, and conſequently directed to *S*. And by the ſame Way of reaſoning, it's plain that the Force acting in all the other Points *c*, *d*, *e*, &c. may alſo be proved to be directed to *S*.

The Reaſon why our Authors conclude that the Force turning the Body from moving in the Line *bf*, to move in the Line *bc*, muſt be pa-

parallel to *cf*, is obvious upon drawing the Parallelogram *b f c g*: For both thoſe Authors take it for a known Truth in Mechanicks, that a Body by two Forces joyning, will deſcribe the Diagonal of a Parallelogram, in the ſame Time it would by any one of thoſe Forces deſcribe one of the Sides. And one of the Forces joyning to produce the Motion *bc*, being *bf*, the other muſt be the other ſide *bg*, parallel to its oppoſite Side *cf*.

It is obſervable, that all that can here be inferred is, that the actual Motion of the Body in the Line *bc*, may be reſolved into the Forces *bf* and *bg*; but then it may as well be reſolved into *bf*, *bo* and *br*; as appears by deſcribing the Parallelogram *b o g r*. So that the Forces *bo* and *br*, neither of which are directed to *S*, might have turned the Body from the Motion *bf* to the Motion *bc*, as well as the Force *bg*. And therefore this Demonſtration, inſtead of proving what is aſſerted, that all

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Bodies endeavouring to move in the Line *bf*, and really moving in the Line *bc*, are turned from *bf* into *bc*, by a Force directed to *S*, only proves that it is poſſible for this Force to turn the Body from *bf* to *bc*, ſince this Force *bg* is really no more than one of an infinite Number of poſſible Forces that may turn the Body from *bf* to *bc*.

It is to no Purpoſe to anſwer, that *bo* and *br*, or any Forces which can turn the Body from *bf* to *bc*, are equivalent to *bg*; that, is when joyned together will produce like Effects with *bg*. It is plain indeed, that ſince the Effect of *bg* in Conjunction with *bf* is to produce *bc*; whatever in Conjunction with *bf* will alſo produce *bc*, is in that Reſpect equivalent to *bg*; but then this does not make appear that any of the Forces *bo* or *br* are themſelves directed to *S*, and can give no Satisfaction when the Nature of any real Force that produces any actual Motion is in Queſtion, eſpecially the

actual

actual Motions of Bodies of any conſiderable Bulk, which are always moved by ſeveral Forces joyning together: For Inſtance, a Ship carry'd in a Stream, and a Man walking on the Ground, may eaſily be ſuppoſed to deſcribe, round ſome Body or other, Areas proportionable to the Times, to as great Exactneſs as any Man from Obſervation can affirm that the Planets do. The Force that moves the Ship, is the Preſſure of the Particles of Water upon her Sides, in many Millions of Directions; and the Force that moves the Man's Body, is the Action of his Animal Spirits contracting his Muſcles in as many Directions. Now, what Idea can any Man have of the Nature of any of thoſe two very different Cauſes, from being told that the whole Forces by which thoſe Motions are perform'd, when joyned together, are equal to one directed to that Body, round which the Ship, or the Man's Body, deſcribe Areas proportionable to the Times?

Times? And what little Reaſon have we from this, to conclude thoſe very different Cauſes to be alike? Or what a ridiculous Thing were it, from this to infer that the Ship, or Man, were attracted by ſome Virtue proceeding from thoſe Bodies, round which they deſcribed ſuch Curves, and that this Attraction were the Cauſe of their Motion? And yet, our Authors have no better Reaſon from this Propoſition, to conclude that the Stars are moved by the Attraction of that Body, which is in the Center, or in one of the Foci of their Orbits.

Notwithſtanding what I have ſaid, this Argument would ſtill prove that a Body moving in any Curve, that in a Plan deſcribes round a certain Point Areas proportionable to the Times, may be forced from a ſtreight Line into thoſe Curves, by a Force directed to that Point: Though it falls far ſhort of proving the poſitive Affirmation, that all Bo-

Bodies moving in any ſuch Curves, are forced into ſuch Motion by a Force of that Direction. The Difference betwixt theſe two Proofs is very conſiderable, for the latter is a Demonſtration, *a priori*, and yields an abſolute Certainty, that any Body deſcribing ſuch a Curve as the Propoſition expreſſes, muſt neceſſarily be actuated by the Cauſe which the Propoſition aſſigns; whereas the former is only a Demonſtration, *a poſteriori*, and ſhows no more than a Poſſibility, that the Cauſe aſſigned in the Propoſition may produce the Motion which the Propoſition expreſſes. Now to ſhew a Certainty that a Thing is ſo, and a Poſſibility that it may be ſo, are very different.

But after all, I have repreſented this Fault in this Demonſtration to be great, only becauſe it is ſo in Reſpect of what the Propoſition aſſerts; for this Defect is not in it ſelf ſo great as ſome may poſſibly imagine: For to ſpeak Truth, nothing

thing ſhould have been affirmed but this Poſſibility; for it's impoſſible to prove any more in ſuch Caſes. Nay, it is a great Matter in Phyſicks, to come this Length, to be abſolutely certain that the Cauſe we aſſign for an Effect, may poſſibly produce it, or is no Ways inconſiſtent with it; which is what we call accounting for an Effect from a Cauſe. And when an Effect may be accounted for from a Cauſe, if ſome conſiderable Inconvenience in ſuppoſing this Cauſe to produce that Effect do not appear, we reckon our ſelves certain that that Effect is produced by that Cauſe: Not that we are ſtrictly ſpeaking certain of it; but becauſe this is the greateſt Certainty we can for the moſt part reach in the abſtruſe Points of Natural Philoſophy. And if Mr. *Newton* had not, by the Habit of affirming Dogmatically in Mathematicks, ſlipt into a poſitive Affirmation, that all Bodies moving in ſuch Curves as he defines, are forced into thoſe Curves by

by the Force he condeſcends on, and had only ſaid that all ſuch Motions might be produced by this Cauſe; his Argument, notwithſtanding the Fault I have obſerved, if it had no other, would have been a valuable Argument in Natural Philoſophy, though not ſufficient for a Foundation to that mighty Superſtructure that is built on it.

But the Truth of the matter is this, our Authors Argument will not ſupport the Affirmation of a Poſſibility, that the given Cauſe can produce the given Effect; which is its great Fault; and if I can make that appear, this Argument will appear to be of no manner of uſe.

In order to make this appear, let us conſider that the Propoſition is affirmed of all Bodies moving in any ſort of Curves, that in a Plan deſcribe round a certain Point Areas proportionable to the Times. Now there are many very different Kinds or Species of ſuch Curves, to wit, Circles, Elipſis's, Hyperbolas,

las, Parabolas, Cicloyds, Spiral Lines; nay, any kind of Curve lying upon a Plan may be performed with ſuch a Motion, as to deſcribe round ſome certain Point Areas proportionable to the Times. So that this Propoſition is affirmed of all ſorts of Curves lying in a Plan, provided they be performed by a certain ſort of Motion.

It is neceſſary that this Propoſition ſhould have been conceived as it is in general Terms, to make it fit for the uſe that is made of it; which is to infer from it, that thoſe particular Curves which the Planets deſcribe, may or muſt be produced by a Centripetal Force. For to juſtify this Inference, it's plain that the Propoſition ought either to prove in general of all Kinds of ſuch Curves, that they may be produced by ſuch a Cauſe, or at leaſt to prove this of thoſe particular Kinds of ſuch Curves, which the Planets are ſuppoſed to deſcribe; and ſince in this Propoſition there is no particular

cular Species of ſuch Curves mentioned, the Propoſition muſt neceſſarily be underſtood in the ſame Terms, in which it is very explicitly conceived, *viz.* to affirm in general of all Curves that in a Plan deſcribe round a certain Point, Areas proportionable to the Times, that they are, or at leaſt may be, produced by a Force directed to that Point, turning the Body that deſcribes theſe Curves from ſtreight Lines; or if this Propoſition is not ſo underſtood, it will not ſerve to prove the 1ſt, 2d and 3d Prop. L. 3.

It appears very clearly from the Demonſtration of Mr. *Newton*'s 2d and Dr. *Gregory*'s 12th Prop. L. 1. or from thoſe Demonſtrations as I have faithfully repeated them, that a Centripetal Force is ſuppoſed to produce the Curve of which the Propoſition ſpeaks, *viz.* all Curves which in a Plan deſcribe round a Point Areas proportionable to the Times; and it is only demonſtrated that the Point round which the Curve deſcribes

ſcribes thoſe Areas, is the Center or Point to which this Force is directed; Whereas the main Thing to have been proved, was that a Centripetal Force could produce all or any Species of ſuch Curves; which is ſuppoſed and not proved. Till this be proved, we are uncertain whether it be poſſible for any Centripetal Force to produce all ſorts of Curves that in a Plan deſcribe round a Point Areas proportionable to the Times; or whether it be poſſible for a Centripetal Force to produce thoſe particular Kinds of ſuch Curves which the Planets deſcribe: Nay, for any thing we learn, from this Argument it may be demonſtrable that ſuch a Force can neither produce all ſuch Curves, nor thoſe particular Species of ~~ſuch~~ Curves which the Planets deſcribe; and ſince this Uncertainty is left, and the main Thing that ought to have been proved is ſuppoſed only, this whole Argument can be of no manner of uſe.

But

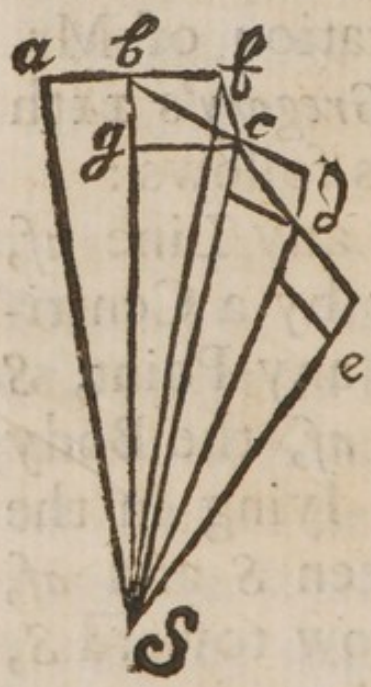
But to deal with all the Fairneſs imaginable in this Matter, it's true that both our Authors have a Proof which to ſome People may perhaps ſeem to be a Proof of this Point; and this Proof I ſhall faithfully repeat, and clearly ſhow that it proves not the Point in Queſtion. This Proof is the Demonſtration of Mr. *Newton*'s 1ſt and Dr. *Gregory*'s 11th Prop. L. 1. which is as follows:

If a Body move in any Line *af*, and be forced from it by a Centripetal Force directed to any Point, *S* not lying in the Line *af*, the Body will move in a Curve lying in the Plan that paſſes between *S* and *af*, the Curve will be hollow toward *S*, and deſcribe round it Areas proportionable to the Times. The Demonſtration is,

Suppoſe the Body in any certain Time to deſcribe the Line *ab*, it would by the Nature of Bodies in Motion deſcribe *bf*=*ab* in an equal Time if nothing hinder it; and if it is acted upon by the Centripetal

Force

Force *bg*, it will alſo in equal Time deſcribe the Diagonal of the Parallelogram *bfcg*, viz. the Line *bc*. The Triangles *Sab* and *Sbf* are equal, becauſe their Baſes *ab* and *bf* are equal, and their Altitude is the ſame. The Triangle *Sbc* and *Sbf* are equal, becauſe on the ſame Baſe *Sb*, and between the ſame Parallels *Sb* and *fc*; but *Sbc* is equal to *Sab*, becauſe both are equal to *Sbf*, and theſe are the Areas deſcribed in equal Times *ab* and *bc*. By the ſame Reaſoning the Force directed to *S*, acting again in the Point *c*, muſt force the Body to deſcribe the Area *Scd*, in the ſame Time it deſcribed the Areas *Sab* or *Sbc*; and ſo for any Number of ſuch Areas: And if any two Numbers of ſuch Areas be taken, the Sums of theſe Areas will be to one another as the Sums of their Times; or if



theſe

theſe Areas be proportionably deminiſh'd, they will be to one another as before. Let us then ſuppoſe our Centripetal Force not to act at different Times upon the Body in diſtant Points of its Motion, but continually and in every Point of its Motion; and conſequently ſuppoſe the Lines *ab*, *bc*, *cd*, *de*, &c, and the Areas comprehended within theſe Lines, to be diminiſh'd in Infinitum, ſo as to bring the Points *b*, *c*, *d*, *e*, &c. in which the Force is ſuppoſed to act, next to one another; then will the Line *abcde* be a Curve, and the Areas this Curve will deſcribe round *S*, will be proportionable to the Times as above. It's plain that it will alſo lie in a Plan, and be hollow towards *S*, &c.

In this Demonſtration it's evident that nothing is proved, but that a Centripetal Force will turn a Body into a Curve, in a Plan deſcribing round this Center Areas proportionable to the Times: that is to ſay, will produce ſuch a Curve;

but it neither is aſſerted nor proved that it can produce all ſuch Curves; neither is there in this Propoſition any Species of ſuch Curves mention'd. So that it proves no more than that ſome ſort of Curves, which in a Plan deſcribe round a Point Areas proportionable to the Times, may be produced by a Centripetal Force turning a Body from a ſtreight Line, without ſhowing whether any more than one Species of ſuch Curves can thus be produced, or ſo much as what that one Species which may be ſo produced is. So that if that which is ſuppoſed in Mr. *Newton*'s 2d, and Dr. *Gregory*'s 12th Prop. L. 1. *viz.* That a Centripetal Force can produce all ſuch Curves, be deny'd, there is here no Proof of it; but the Matter is left at an abſolute Uncertainty, and we are ſo far from knowing that a Centripetal Force can produce all Curves, which in a Plan deſcribe round that Center Areas proportionable to the Times, that we know not whether this Cauſe can pro-

produce any more then one Species of ſuch Curves: nay, not ſo much as what this one which it can produce is. And ſince this Matter is left at ſuch an Uncertainty, I ſhall proſecute the Demonſtration of Mr. *Newton*'s 1ſt and Dr. *Gregory*'s 11th Prop. L. 1. and demonſtrate in the following *Theorem*, what that Curve is which this Cauſe can only produce.

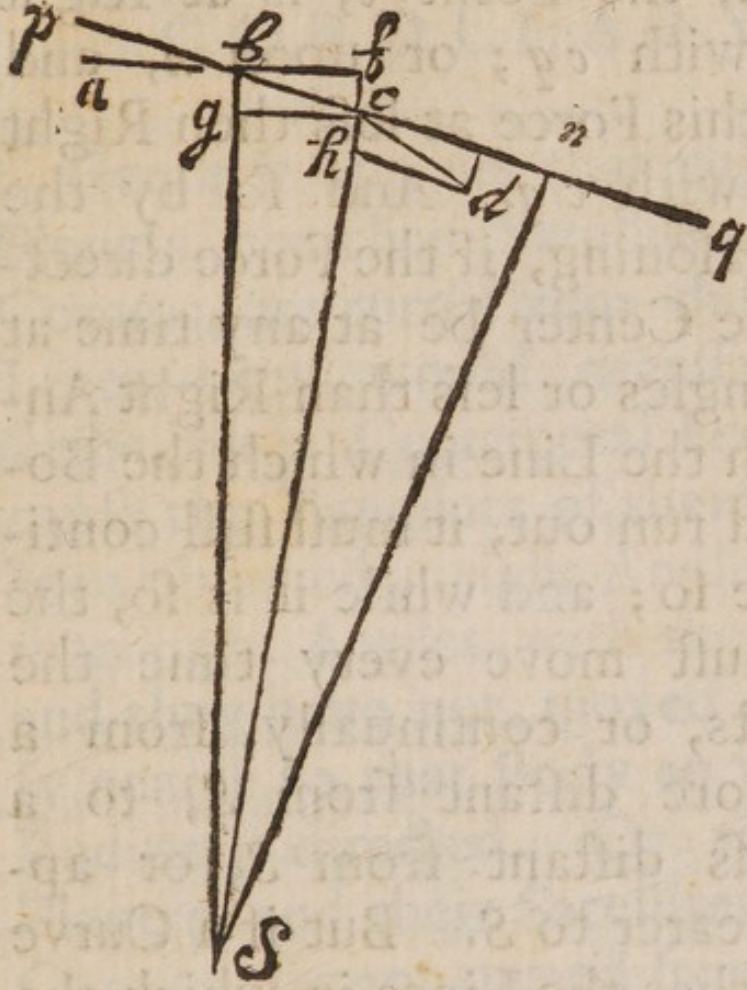
THEOREM I.

A Body turned from a ſtreight-lined Motion into a Curve that lies in a Plan, and deſcribes round any Point S, *Areas proportionable to the Times, by a continuing Centripetal Force directed to* S, *muſt either move conſtantly away from* S, *or come conſtantly nearer to it in a Spiral Line.*

Let the Body's ſtreight-lined Motion be the Line *a b f*, let the Centripetal Force directed to *S*, be ſuppoſed to act upon the Body at the

Point *b*, the Line *bf* in which the Body at *b* would run out, muſt make with *bS*, the Line of the Direction of the Centripetal Force acting in *b*, either a Right, an Acute, or an Obtuſe Angle. If the Angle *Sbf* be a Right or Acute Angle, then is the Angle *Sbc* (a Part of that Angle) leſs than a Right Angle. Draw out *bc* in Infinitum toward *q* and *p*, let us with our Authors conceive the Point *c* to be the next Point in which the Centripetal Force acts; which being ſuppoſed to act continually or in every Point, the Point *c* muſt be the next Point to *b* in the Line *bq*. Drop a Perpendicular from *S*, upon the Line *pq*, it will fall ſomewhere betwixt *b* and *q*; either upon *c* the next Point to *b* in that Line, or upon ſome other Point betwixt *c* and *q*: Suppoſe upon the Point *n*. If the Perpendicular fall upon *c*, then is *c* the neareſt Point in the Line *pq* to the Point *S*, nearer to wit than the Point *b*; if the Perpendicular fall upon *n*, then is *c* nearer to *S* than *b*,

be-



because nearer to *n*: So that the Centripetal Force meeting with the Line in which the Body would run out at Right Angles, or less than Right Angles, must necessarily force the Body to move from a Point more distant to a Point less distant from the Center *S*. The Line *c q* is that Line in which the Body at *c* would run out next, and the Point *c* is the next Point in which the Centripetal Force is supposed to act; but a Perpendicular from *S* upon *p q* fell, as above, either upon *c*; and then the Force directed to *S*

acting in the Point *c*, is at Right Angles with *c q*; or upon *n*, and then is this Force at leſs then Right Angles with *c q*. And ſo by the ſame Reaſoning, if the Force directed to the Center be at any time at Right Angles or leſs than Right Angles with the Line in which the Body would run out, it muſt ſtill continue to be ſo; and while it is ſo, the Body muſt move every time the Force acts, or continually, from a Point more diſtant from *S*, to a Point leſs diſtant from *S*, or approach nearer to *S*. But if a Curve be ſuch, that the Lines in which the Body would run out, *viz.* the Tangents of the Curve, make with the Radius conſtantly more than Right Angles; then is the Body that moves in that Curve moving continually away from *S*: Or if the Tangent and Radius of this Curve at any time be at Right Angles, or leſs than Right Angles, then muſt the moving Body come conſtantly nearer to the Center *S* in a Spiral Line. *Q. E. D.*

C O-

COROLLARY.

Hence it appears that neither the Planets, nor their Satellites, nor the Comets, are turn'd from the ſtreight Lines they would neceſſarily deſcribe, by a Centripetal Force; becauſe the Tangents of them all have been obſerved at right Angles, or leſs than right Angles with the Radius; and they have not moved conſtantly nearer to that Body to which the Radius is directed. Or rather the Planets, and their Satellites, and the Comets, are not turned from ſtreight Lines by a Centripetal Force; becauſe they neither move continually away from the Bodies round which they revolve, nor come conſtantly nearer to them in a ſpiral Line.

Since Mr. *Newton*'s Natural Philoſophy extends no further than to what concerns the Syſtem of the Univerſe; and his whole Scheme of the Syſtem of the Univerſe is built upon this Propoſition, which I have

diſproved; and ſuppoſes the whole Bodies of that Syſtem to move by Centripetal Force, which I have demonſtrated to be impoſſible: What I have ſaid is ſufficient to overturn his whole Scheme. But ſince all his other Reaſonings beſide their Dependance upon this Argument, which I have diſproved, or their Dependance upon one another, are as defective as this which I have conſider'd; I ſhall, for further Satisfaction upon this Subject, proceed to remark upon all the main Branches of his Reaſoning, that the World may ſee what ſort of Arguments thoſe are, with which they have been ſo long deceived.

The next Branch of his Reaſoning upon this Subject, is his Proof, That in the Caſe of a Body, round which another revolves, being in Motion, the Body deſcribing round it Areas proportionable to the Times, is forced into its Motion by all the Force by which that Body round which it deſcribes thoſe Areas

as is moved, and beſide that by a Centripetal Force directed to that Body. This Caſe, as I obſerved before, is diſtinguiſh'd from the other by Dr. *Gregory*; and his Way of propoſing this Argument ſets it in a clearer Light. Mr. *Newton* proves this Point in his 2d and 3d *Pro. L.* 1. and Dr. *Gregory* in his 20th *Pro. L.* 1. The Sum of both their Arguments is,

If equal and parallel Motion be deſtroyed or taken from two moving Bodies, they will move in reſpect of each other as before: So that if *B* move round *S* in the Orbit *B n*, and *A* at the ſame Time move round *B* in the Orbit *A c*, ſubſtracting from *B* all its Motion, and from *A* a Motion equal and parallel to all *B*'s Motion, then will *A* continue to deſcribe round *B* the Orbit *A c* as before; but if in deſcribing *A c*, it deſcribe round *B* at reſt Areas proportionable to the Times; by the Proof of the former Caſe, the Force by which it is moved is di-

rected to *B*; but its Motion conſiſted at firſt of what was deſtroyed, and what remains. And what was deſtroyed being a Motion equal and parallel to all *B*'s Motion, was produced by all the Force that produc'd *B*'s Motion; Effects being proportionable to their Cauſes. So that all the Force by which *A* moves, is all the Force by which *B* moves, and a Force directed to *B*.

I have nothing to ſay againſt this Demonſtration, as depending upon the former; my Deſign being only in every Argument to obſerve what Fault is peculiar to it: So that in conſidering this and all other of our Authors Arguments, I ſhall ſtill ſuppoſe

ſuppoſe all former Propoſitions fairly demonſtrated. This being premiſed, the Fault of this Demonſtration, which I ſhall firſt obſerve, is much of the ſame kind with the firſt I obſerved in the former, *viz.* It is poſitively affirmed of *A* that its Motion is produced by the Force that produces *B*'s Motion, and by a Force directed to *B*, and only proved that *A*'s Motion might poſſibly be produced by ſuch Forces.

It is plain that the real Motion ſuppoſed to be performed by *A*, may be ſuppoſed divided into two Motions different from theſe two in which it is ſuppoſed divided, *viz.* different from the Motion of *B*, and a Motion round *B*, as well as it may be ſuppoſed divided into thoſe Motions. And then by our Author's Reaſoning, the Cauſes of theſe two different Motions muſt be proportionable to the Effects, and conſequently different from the Cauſes aſſign'd; and ſince there are infinite Numbers of poſſible Diviſions of any Motion, ſo

ſo are there infinite Numbers of different Cauſes, which by this Way of Reaſoning may be proved to be the Cauſes of this or any other Motion. So that all that is here proved, and all that ought to have been here aſſerted, is, that the Motion in Queſtion may be accounted for from the given Cauſes; and then, as I obſerved before, if there had not appear'd ſome Inconvenience in admitting that to be the Cauſe, this Argument might have been of Uſe in Phyſicks: But the chief Thing here to be obſerved is, that there is an Inconvenience in admitting this Cauſe to be the Cauſe of that Motion; ſo great and ſo evident, that it could not poſſibly have been overlook'd, if Men's Inquiry after the Inconveniences of admitting this Cauſe had not been laid aſleep by the ſhew of a poſitive Demonſtration, that this is the Cauſe of the given Motion; nay the Inconvenience in admitting it to be ſo, is ſo extreamly obvious, that there was

a Neceſſity for uſing another Art to conceal it, *viz.* not ſo much as to mention one part of this Cauſe, the very Name of which would have diſcovered the Abſurdity.

For making all this appear, let us conſider that the Cauſe of *B*'s Motion round *S*, which is the one part of *A*'s Motion, is according to the Proof of Caſe 1ſt, a Force by which the Body, by the Nature of Bodies in Motion, endeavours to run out in all the Tangents of the Curve *B n*, and a Centripetal Force directed to *S*. The other Part into which *A*'s Motion is divided, *viz.* a Motion in the Curve *A c* round *B* at Reſt, by the Proof of Caſe firſt, is produced by a Force with which the Body endeavours to run out in all the Tangents of the Curve *A c*, and a Centripetal Force directed to *B*: Now both our Authors take very good Care not to mention in this Place that half of their Cauſe, which conſiſts in the Endeavour of the Body to run out in Tangents; which

if

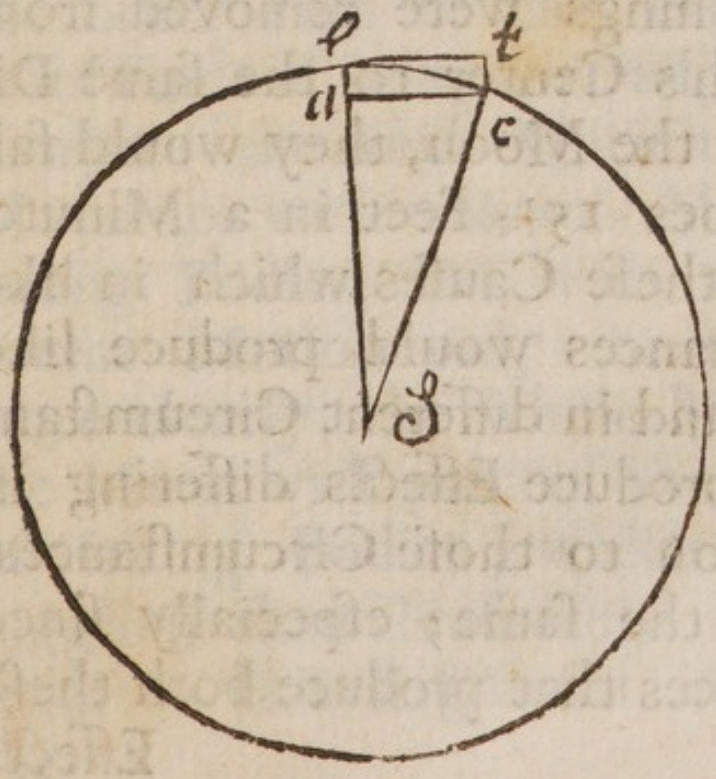
if they had not done, the Abſurdity of ſuppoſing the Cauſe of any Body's Motion to be an Endeavour in the Body at every Inſtant of time to run out in two different Lines, (as the Tangents of thoſe two different Curves are) at the ſame Time, is ſo very groſs and evident, that it could never have been ſwallowed by any Man of common Senſe.

From this, it's plain, I might draw a Mathematical Demonſtration, *a priori*, independent of the former Demonſtration, proving that *Satellites* in particular are not moved by a Centripetal Force; but the former Demonſtration does this ſo clearly, that any more Proofs were abſolutely needleſs; and beſide, my Deſign in this Place is only to obſerve the chief Faults of the main Branches of the Reaſoning that ſupports Mr. *Newton*'s Philoſophy.

Mr. *Newton*, *Pro.* 4. *L.* 3. affirms, That the Force by which the Moon is hinder'd from running out in ſtreight Lines and kept in her Orbit,

Orbit, is the ſame with that Force by which heavy Things fall to the Ground; and Dr. *Gregory*, in his 46th *Prop. L.* 1. aſſerts the ſame, and their Demonſtrations are alike, *viz.*

The Moon's middle Diſtance is 60 Semidiameters of the Earth by Calculation; it appears alſo by Calculation, that ſhe deſcribes in a Minute the Arch *l c*, whoſe Verſe Sine *l a* is $15\frac{1}{12}$ Feet; ſo that in deſcribing that Arch, or in a Minute ſhe falls from her Tangent *l t* the Space *t c* = *l a*, that is $15\frac{1}{12}$ Feet. Now the Force which makes the Moon fall from her Tangents being in different Diſtances, as the Squares of thoſe Diſtances would force her if upon the Surface, or at the Diſtance of 1 Se-



1 Semidiamiter to move in a Minute a Space which is to $15\frac{1}{12}$ Feet as the Square of 60 to the Square of 1, *viz.* $60 \times 60 \times 15\frac{1}{12}$ Feet in a Minute; but it is found by exact Experiment that heavy Things with us, at the Diſtance of 1 Semidiameter, fall $15\frac{1}{12}$ Feet in a Second; and it's well know that they accelerate their Motion in falling in a Duplicate Ratio of the Time of falling: So that in a Minute, or 60 Seconds, they muſt fall $60 \times 60 \times 15\frac{1}{12}$ Feet, the very ſame Space the Moon would fall at the ſame Diſtance. And by inverting the ſame Computation, if heavy Things were removed from the Earth's Center to the ſame Diſtance as the Moon, they would fall as ſhe does $15\frac{1}{12}$ Feet in a Minute. So that theſe Cauſes which in like Circumſtances would produce like Effects, and in different Circumſtances do produce Effects differing in Proportion to thoſe Circumſtances, muſt be the ſame; eſpecially ſince both Forces that produce both theſe

Effects

Effects are directed to the ſame Center.

Mr. *Newton* adds another Reaſon in the latter End of his Demonſtration, *viz.* That the Cauſe which turns the Moon from her Tangents muſt be the ſame with that Cauſe which forces heavy Things toward the Center; becauſe if thoſe Cauſes were different, both together would force Bodies to fall 30½ Feet in a Second contrary to Experience. But this Reaſon Dr. *Gregory* very judiciouſly omits; and it's ſtrange that ſo plain a *petitio principij* ſhould have eſcaped Mr. *Newton*'s Pen! As for the other Part of this Proof, the chief Fault of it is, that our Authors compare the real Motion of the Moon not with the real Motion of falling Bodies, but with their apparent Motion only: or to ſpeak more clearly, the whole Motion of the Moon with part of the Motion of falling Bodies; which is liker Juggling than Reaſoning: And this Fault in this Argument is of the great-

greateſt Conſequence, becauſe the Nature of the Argument is, from the Likeneſs of Effects, to infer that thoſe Effects are produced by the ſame Cauſe.

It appears very clearly that the real Motion of the Moon is compared with the apparent Part of the Motion of falling Bodies only, even from what Mr. *Newton* himſelf ſays; for he acknowledges that his Calculations of thoſe Motions depend upon the Suppoſition of the Earth being at Reſt. Now ſince the Earth appears to us at Reſt, and we are altogether inſenſible of its Motion, and conſequently of the Motions of Things that accompany the Earth in its Motion; it's plain that this Part of the Motion of falling Bodies which they perform in accompanying the Earth, though it be a real Motion, is to us inſenſible; and that Part of the Motion of a falling Body by which it differs from the Earth's Motion, is all that appears to us, and all that our Author brings into his Calcula-

tion,

tion, ſince he ſuppoſes the Earth to be at Reſt. It's true, in calculating theſe Motions, there was no need of taking into the Calculation that Part of the real Motion of the Moon or of falling Bodies, by which they accompany the Earth in its Orbit; becauſe this Motion is in the Moon, and falling Bodies perfectly equal; and whether we take this Part of their Motion into the Account or leave it out, the Difference of theſe Motions will be the ſame. So that if Mr. *Newton* had only ſuppoſed the Earth at Reſt from the Motion in its Orbit, his Reaſoning had been fair; but he ſuppoſes alſo the Earth at Reſt from the turning upon its Axis; as appears by his leaving out of his Account of the Motion of a falling Body that Part of its Motion which depends upon the Earth's Diurnal Rotation; and compares only the remaining Part of the Motion of falling Bodies with the Moon's whole Motion. So that if what Mr. *Newton*

ton pretends to demonſtrate by his Calculation be true, *viz.* that the Part of a falling Body's Motion which he conſiders is the full adequate Effect of ſuch a Cauſe as that which turns the Moon in her Orbit; then does he fully demonſtrate that a different and greater Effect cannot poſſibly be produced by that Cauſe. Now that the Effect of the Force which drives falling Bodies from running out in ſtreight Lines, is more than what he conſiders, is thus evident.

The Earth by turning upon its Axis would certainly throw out all Bodies lying looſe upon its Surface in Tangents; or rather thoſe Bodies being in Motion would by the Nature of Motion neceſſarily run out in thoſe ſtreight Lines, as well as the Moon would run out in the Tangents of her Orbit, if ſome Force did not hinder them: And if Gravitation were a Force that did no more than hinder Bodies from running out in Tangents, then it might in my Opinion be very reaſonably

ſonably thought to be the ſame with that Cauſe which hinders the Moon from running out in Tangents. But ſince Gravitation not only forces heavy Things to fall ſo far from their Tangents as to keep into a revolving Orbit, but likewiſe forces them to endeavour always to run within this Orbit toward the Center in a Spiral Line; it ſeems very unlikely that this is that ſame Cauſe which turns the Moon and other Planets; ſince that Cauſe, whether acting near or far from that Body from which it is ſuppoſed to proceed, ſtrictly obſerves this Law, never to force any Bodies upon which it acts within their revolving Orbit; which on the contrary Gravitation always does. And certainly if Likeneſs of Effects be a Proof that they proceed from the ſame Cauſe, their Unlikeneſs is a much ſtronger Proof that their Cauſes cannot be the ſame; and conſequently, I have much better Reaſon dogmatically to affirm that the Cauſe which turns the Moon

in

in her Orbit, and that which forces heavy Things to fall, is not the ſame, from having ſhew'd their Effects to be different, than Mr. *Newton* had to affirm them to be the ſame from the Likeneſs of Effects, though he had fairly demonſtrated this Likeneſs. For Cauſes that are not the ſame may produce like Effects; but the ſame Cauſe cannot produce unlike Effects. But I am not fond of dogmatical Affirmations in Phyſicks, neither is it my Deſign in this Place to affirm any thing; but to examine the Reaſons our Authors bring to juſtify their Aſſertions. So that I ſhall content my ſelf with making appear that our Authors Demonſtration, if it demonſtrate any thing, demonſtrates the Contradiction of that Aſſertion, for proving of which it is adduced.

For making of this more fully appear, let us conſider that the $15\frac{1}{12}$ Feet which our Author affirms to be the Space a falling Body is forced by Gravitation to move in a Second, is that Space which it moves

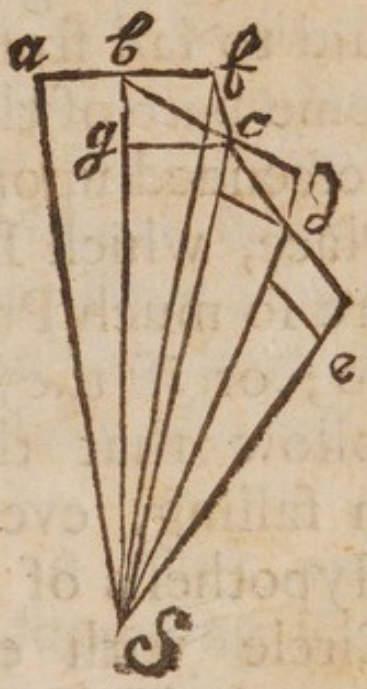
upon

upon the Suppoſition of the Earth being at Reſt, or that Space which it appears to us to fall in a Second: And it's alſo certain that beſide this Space of $15\frac{1}{12}$ Feet in a Second which it appears to us to fall, it does really fall a Space in a Second equal to that Space which we and all other Things that to us appear at Reſt do really fall, toward the Earth's Center, from thoſe Tangents or ſtreight Lines into which we muſt neceſſarily run out, if Gravitation did not hinder us and force us from theſe Tangents. So that, according to our Authors Way of computing, a falling Body falls in a Second a Space equal to the Verſe Sine of an Arch of the Earth's Circumference of $17''+15\frac{1}{12}$ Feet; and if his Proof that the falling $15\frac{1}{12}$ Feet in a Second is the full Effect, that the Cauſe which turns the Moon in her Orbit would have if it acted upon the falling Body, certainly the falling $15\frac{1}{12}$ Feet+the Verſe Sine of the ſaid Arch, which is the real Effect

fect of Gravitation, cannot poſſibly be produced by that Cauſe; and therefore Gravity, the Cauſe that produces this actual Motion, muſt be different from that Cauſe that turns the Moon in her Orbit.

I cannot paſs over this Point without obſerving another Fault in this Demonſtration, *viz.* That our Authors affirm the Moon to fall from her Tangents a Space equal to the Verſe Sine of any Arch in deſcribing that Arch; that is to ſay, they condeſcend upon a certain Tangent, and conceive the Moon to be continuing to fall from that Tangent; notwithſtanding that in Reality a Body moving in a Curve endeavours to run out in the Tangents of every Point of that Curve, and muſt by a Force acting upon them, in every Point of their Motion, be forced from theſe Tangents. So that in Reality it is from all poſſible Tangents a Body moving in a Curve falls, or is really drove by that Force which forces it to de-

deſcribe a Curve; as appears clearly from our Authors Account of a Curve, which I have repeated above, *viz.* The Body deſcribing the Curve *a b c d e*, in the Points *b*, *c*, *d*, and *e*, is forced from the Tangents of every one of thoſe Points; and in deſcribing *b c*, falls from *b f* the Tangent of *b*, the Space *c f* = *b g*; and in performing, *c d*, falls from the Tangent of the Point *c*, as before from the Tangent of the Point *b*; and in performing any Number of ſuch Motions, falls from that Number of Points the ſame Number of ſuch Spaces. If this be deny'd, and if it be aſſerted that a Body moving in an Orbit continues to fall from one Tangent, I ask where is that Tangent from which it falls? Or how comes it, when it has deſcribed a Semicircle, to leave



off falling and begin to riſe to that Tangent again? Since in the Senſe it can at any time be ſaid to fall from its Tangents, it can always be ſaid to fall from them. At this rate ſome part of the Orbit muſt be condeſcended upon to be the uppermoſt Place, which I believe our Authors are ſo much Philoſophers as not to do; or if they would, then will it follow that the Moon accelerates in falling, even upon our Authors Hypotheſis of her Motion being a Circle with equal Velocity, *viz.* that the Velocity of her falling Motion encreaſes in a Proportion to the Times of falling, as the Verſe Sines of Arches to their Arches. And it is very ſtrange, if any part of a Motion ſo uniform and equable as the Motion in a Circle with equable Velocity, ſhould be ſo variable and accelerate in ſuch Proportion; but much more ſtrange that after compleating 90 Degrees of this Circle, the Increaſe of Velocity ſhould begin to abate. Beſide, if all this be

true,

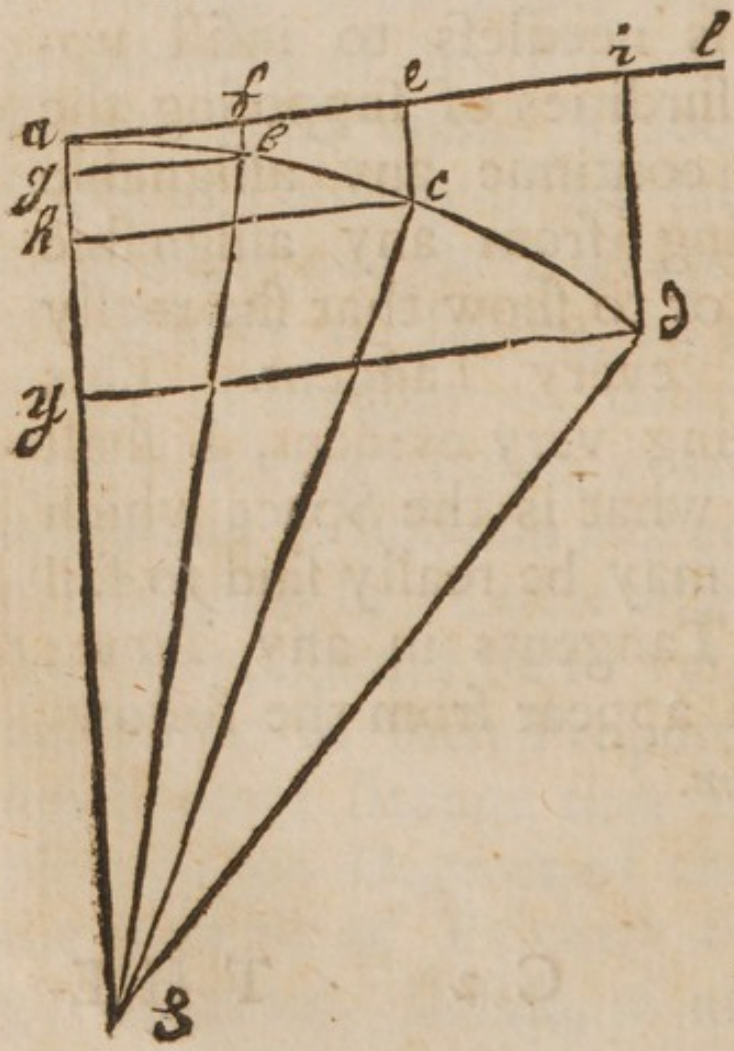
true, then it is not true that in any Minute of the Moon's periodical Time, ſhe falls $15\frac{1}{12}$ Feet; for at this rate ſhe only falls juſt ſo much the firſt Minute ſhe begins to fall from the Tangent of her higheſt Point, and in that Minute before ſhe come to her loweſt Point; and in all other Minutes in that Part of her Orbit where ſhe falls, ſhe falls more then $15\frac{1}{12}$ Feet.

But it is needleſs to inſiſt upon the Abſurdities of ſuppoſing the Moon to continue any aſſignable Time falling from any aſſignable Tangent; or to ſhow that ſhe really falls from every Tangent. This Matter being very evident, I ſhall next ſhow what is the Space which the Moon may be really ſaid to fall from her Tangents in any Time; which will appear from the following *Theorem.*

THEOREM II.

A Body describing any Arch a d, *really falls from the Tangent of every Point of that Arch a certain Space, and the Sum of all those Spaces is, in Respect of the Verse Sine of* a d, *infinitely little.*

Suppose *a d* divided into equal Parts *a c* and *c d*; suppose also the Force turning the Body into this Curve to act in the Points *a* and *c*, the Force acting in *a*, forces the Body to fall



fall from the Tangent of the Point *a*, the Space *e c*; and another Force equal to the former acting at *c*, forces the Body from the Tangent of the Point *c* a Space equal to *e c*. So that if the Arch *a d* be ſuppoſed performed by two Puſhes of a Force acting in two Points *a* and *c*, the Space the Body will fall by theſe Puſhes, *viz.* 2 *e c* is not ſo great as the Space *i d*, which it would have fallen from the Tangent *a l*, if it had been forced to deſcribe *a d* by the Force *a y*: Or which is all one, the Force *a h*, twice repeated at the Points *a* and *c*, that is, 2 *a h* is leſs then *a y*. And if again we ſuppoſe the Arch *a c*, produced by two Forces acting in the Points *a* and *b*, the Sum of theſe two Forces or the Sum of their Effects, *viz.* the Spaces which they force the Body to fall from the Tangents of the Points *a* and *b*, are leſs than the Force *a h*, or the Space *e c*: Therefore if the Arch *a b c d*, be ſuppoſed produced by three Forces acting in the Points *a*, *b*, and *c*, the

Sum of theſe three Forces or the Sum of their Effects, *viz.* the Spaces they force the Body to fall from theſe three Tangents, is leſs than when this Arch was ſuppoſed to be produced by two; and ſo the more Points the Force be ſuppoſed to act in, the leſs is the Sum of thoſe Forces or the Sum of the Spaces which they force the Body to fall from its Tangents, if compared with *a y* or *i d*. And ſince it appears plainly both from our Authors Way of accounting for a Curve from a continuing Force, and from what I have already ſaid, that a Body moving in a Curve really endeavours to run out in ſtreight Lines at every Point, that is, at an infinite Number of Points; and the continuing Force really acts in all theſe Points, and at every Point forces the Body from the Tangent of that Point; and ſince I have now ſhewn that the Sum of the Spaces, which a Body forced from Tangents by a Force acting in different Points falls from

thoſe Tangents, diminiſhes as the Number of Points in which this Force is ſuppoſed to act increaſes. The Sum of the Spaces, which this Force that acts in one infinite Number of Points forces the Body to fall from all its Tangents in deſcribing the Arch *a d*, is to the Space *i d*, or its Equal *a y*, infinitely little.

COROLLARY.

Hence it appears that all Eſtimates of the Quantity of a Force turning a Body from ſtreight Lines into a Curve, if they meaſure the Force that produces any aſſignable Arch by the Verſe Sine of that Arch, or compare the Forces that produce any two Arches, one whereof is greater than the other, by the Verſe Sines of thoſe Arches, are erroneous.

Mr. *Newton*, in his 5th Prop. L. 3. and Dr. *Gregory*, in his 47th Prop. L. 1. aſſert that the Cauſe

which keeps all the Planets, both Primary and Secondary, in their Orbits, is the ſame with the Cauſe that keeps the Moon in her Orbit, *viz.* Gravitation: And though I am inclined to think the Cauſe that keeps the Primary Planets in their Orbits round the Sun, to be ſomewhat different from that which keeps Secondary Planets in their Orbits round their Primaries; yet I do not ſee any ſo great Fault peculiar to this Propoſition as to have mentioned it, were it not that both our Authors draw from it a very important Corollary, which will by no means follow. This Corollary is, That ſince the Secundary Planets gravitate upon their Primaries, and the Primary Planets upon the Sun, Action and Re-action being mutual, the Primary Planets muſt alſo gravitate upon their Satellites, and the Sun upon the Primary Planets.

In drawing this Corollary, it's evident that our Authors ſuppoſe their Gravitation to be the Action

of

of thoſe Bodies to which that Force is directed; for proving of which, they offer not ſo much as to ſhew one Argument, but ſuppoſe it only; and therefore no more is requiſite for overturning this *gratis dictum*, but to deny this Force to be the Action of thoſe Bodies to which it is directed, or at leaſt to deny that it appears to be ſo.

But that I may not here be thought to deny a Thing that is very probable, for no Reaſon, but becauſe it is not prov'd: I ſhall ſhow that what is ſuppoſed in this Corollary, is not only improbable, but inconſiſtent with all thoſe Laws of Nature that have ever been diſcovered by any Man beſide Mr. *Newton* and his Followers. In order to which, let us diſtinguiſh betwixt the mediate and immediate Action of Bodies. The firſt is, when the Action of one Body is communicated to another by ſome intermediate Agent; as when I throw a Stone againſt the Wall, I act upon the Wall by the Means of

the Stone. The ſecond is, when one Body, without the Intervention of any other Being to aſſiſt it, acts it ſelf upon another Body; and in this Senſe it never did appear that Bodies could act upon one another otherways than by Touch; and it is from the Nature of Touch, which cannot but be equal and mutual, that this ſort of Action, which can only be properly called the Action of Bodies, is neceſſarily mutual. The firſt kind of Action is not properly Action; but only a Way of ſpeaking accommodated to the Ways of thinking of the Vulgar: For when a Man throws a Stone againſt the Wall, his Hand acts upon the Stone, and not upon the Wall; and the Stone acts upon the Wall. Juſt ſo a Horſe that pulls a Stone, which is faſtned to him by a Rope, only pulls or acts upon the Rope; and it depends upon the Nature and ſtrong Coheſion of the Rope, that it is fit to communicate this Action to the Stone. When Bodies act immediately upon each other by Touch,

then

then is Reaction equal and of a contrary Direction by a Phyſical Neceſſity; but when Bodies act mediately upon each other, then is Action and Reaction mutual or not mutual, according to the Nature of that which conveys the Action of one Body to the other; as the two foregoing Inſtances ſufficiently ſhow: For if a Horſe is faſtened to a Stone by a Rope, and this Rope be ſtrong enough and no other Thing hinder, this Rope will communicate to the Stone the Action of the Horſe, and the ſame Rope will communicate to the Horſe the Reaction of the Stone: But then, in the other Inſtance of a Man throwing a Stone againſt the Wall, there is no Neceſſity in Nature that the Wall ſhould throw another Stone at him again. Now ſince Mr. *Newton* ſays that his Cauſe proceeds from Bodies, and penetrates other Bodies; and ſince it is not to be ſuppoſed that he means to aſſert that Bodies proceed from themſelves and penetrate each other,

we

we may ſafely conclude that his Cauſe, or that whatever it be that thus penetrates, acts, and impreſſes upon Bodies this Force directed to each other, is a Being different from the Bodies themſelves; and if ſo, all the Reaction that is in this Caſe neceſſary, is that the Bodies which are acted upon by this Inſtrument of Attraction, muſt react upon that Inſtrument, provided the Author of it will ſuppoſe it to be ſuch a Being as can be reacted upon by Bodies. This Inſtrument may alſo be ſuppoſed fit to communicate to that Body from whence it proceeds this Reaction of thoſe Bodies that react upon it. But then it is plain that this would not be Proof, which our Author pretends, but Hypotheſis only; and ſuch an Hypotheſis would be preſſed with many and great Difficulties, which it is not my Buſineſs here to ſhow. All I am concerned to do, is what I have already done, *viz.* to make appear that our Author's Reaſons do not prove his Aſſertions.

It's

It's ſtrange he did not rather chuſe to prove the Mutualneſs of Attraction in the Stars from the Likeneſs of the Nature of thoſe Bodies, than from the general Law of Action and Reaction; ſince it is from this Likeneſs, and not from the Law of Action and Reaction, that all natural Attractions which are mutual do proceed. For Inſtance: The Attraction of two Loadſtones; the Actions as well as Reactions of which Bodies appear to depend upon ſomething particular in their own Nature, different from that Part of their Nature common to them and all other Bodies, by which they act and react upon any Body whatever. And two Stars being as like, and to be ſuppoſed of one Nature as much as two Loadſtones; ſince our Author proves one of them to attract the other, or to ſend forth ſomething that penetrates its Subſtance, and puſhes that other toward it; why might not he from the Likeneſs of the Nature of thoſe Bodies infer, that this

this other Body would ſend forth ſome ſuch Thing to attract it? This Way of Reaſoning would have carry'd in it ſome Probability, and conſequently might very well have been uſed in Natural Philoſophy.

But our Author makes uſe of no probable Reaſonings; he had a Mind to ſecure his Philoſophy from all Cavils and Diſputes, by aſſerting nothing without full and abſolute Demonſtration, or at leaſt not without ſomething dreſſed up like ſuch, as he himſelf tells us * in his Introduction to his third Book; which contains his Philoſophy. He foreſaw in general, that his Philoſophy would be called in Queſtion, and objected againſt, if without that Security; and to this particular probable Argument, if he had uſed it, many Objections might have been

* *Ne res in Diſputationes trahatur Summam Libri; tranſtuli in propoſitiones more Mathematico.*

made,

made, *viz.* Though in the Caſe of the Attraction of the Loadſtone and ſome others, Attraction may appear to be mutual; yet in ſome Attractions this does not appear. It might alſo have been univerſally denied of all Attractions, that the Force, or that which impreſſes the Force, appears to proceed from thoſe Bodies to which this Force is directed, which are ſaid to perform this Attraction in the common Way of ſpeaking; and this can never be proved. Nay, an Attraction, as properly ſo called as any other, may be inſtanced, in which it appears that the Force, or that which impreſſes the Force, proceeds not from that which is ſaid to attract, and the Attraction appears alſo not to be mutual, *viz.* that Attraction by which a Void draws or ſucks into it Air, Water, *&c.* And yet, this ſame Attraction, which is of ſo very different a Nature from our Author's, may by as good Argument as the Nature of the Subject will allow be proved very

like

like ſome part of that Force which hinders the Primary Planets from running out in Tangents. But to do this, is not proper in this Place. And whether this can be done or not, ſtill from what has been ſaid it appears, that if our Author had uſed the probable Argument I mention'd, or if any Man think fit to uſe it in his Behalf, yet there might have been more Objections made againſt it, than would have ballenced its Probability; but however, if he had uſed that Argument, it would ſtill have had ſome Weight, whereas what he urges can be of no manner of Uſe.

Mr. *Newton* draws another Corollary from his 5th Prop. and the Corollary I ſpoke of, *viz.* That all the Planets gravitate upon each other; and infers from this, that when near one another, they muſt neceſſarily diſturb each others Motions, as ſome of them appear to do. But this Diſturbance that appears, if rightly conſider'd, will appear liker the Effect

fect of a Power in thoſe Bodies mutually to drive away, than mutually to attract each other. But this I leave to Aſtronomers. As for the Corollary itſelf, I cannot ſee how it follows from the Propoſition or former Corollary; and our Author ſays nothing to ſhow the Connexion of this Corollary with any of them, nor gives any Reaſon for his drawing ſuch a Corollary: Neither can I find any Reaſon he had for ſo doing, but to honour his own Invention, and dignify his Cauſe with the Title of *Catholick* and *Univerſal*, which appears from his 6th and 7th Prop. which depend upon this Corollary, wherein he aſſerts univerſally of all Bodies whatever that they attract each other.

He aſſerts alſo in theſe Propoſitions, That the Force of his Attraction acting upon different Bodies which are at the ſame Diſtance from the attracting Body, is as the Quantity of Matter which thoſe Bodies contain: His Proof of which is to this Purpoſe. It

It appears univerſally in all Bodies that gravitate upon any other Body, that whatever their Bigneſs or Quantity of Matter be when at like Diſtances from the attracting Body, they fall equal Spaces toward it in equal Times, or fall to it with equal Velocity, and the Force that accelerates Bodies of different Quantities of Matter equally, being as their Quantity of Matter; This Force, which thus accelerates Bodies of unequal Quantity of Matter equally, muſt be as the Quantities of thoſe Bodies. Moreover, all the Parts of thoſe Bodies muſt neceſſarily attract with a Force proportionable to their Quantity; for if any Sort of Parts in a Planet attracted more or leſs than in Proportion to their Quantity, the whole Planet would attract more or leſs than according to its Quantity, as it moſt abounded of the one or other Sort of theſe Parts.

This Proof has ſo many, ſo great, and ſo evident Defects, that it ſcarce

deſerves

deſerves the Name. Some of the moſt obvious of them, I ſhall mention; and enlarge upon that only, which to me ſeems moſt conſiderable.

It's plain then, in the firſt Place, that the Queſtion is here begg'd, and the Attraction of a Planet ſuppoſed to be made up of the Attractions of its Parts; for though it may be thought that the Earth attracts its Parts, becauſe they fall to it, yet I challenge any to ſhow from any Appearance that thoſe Parts attract any Body in Nature, or any ways produce upon them any ſenſible Effect which may be attributed to their Attraction.

It's here alſo ſuppoſed, that Planets of unequal Quantity of Matter gravitate equally; when only the Difference of Bulk and not Quantity appears, which are very different.

But the chief Fault of this Argument is, that it depends upon this Aſſertion, that Forces which pro-

duce

duce a Motion of equal Velocity in Bodies of unequal Quantity are as the Quantities of thoſe Bodies; which is apparently falſe, and as far as I can ſee, has not the leaſt Shew of Truth; For Inſtance, Two Ships of unequal Bigneſs and Quantity, carried by the Stream of a River, are brought into a Motion of equal Velocity, by the Force of the Preſſure of the Water: And certainly the Force of any Quantity of Water that preſſes upon the one Ship, is equal to the Force of an equal Quantity of the Water that preſſes upon the other; and conſequently, the Force of all the Water that preſſes upon the one Ship, is to the Force of all the Water that preſſes upon the other, as that Part of their Surfaces upon which the Water preſſes, which in Ships of different Quantity might be made equal; nay, the Quantity of that Part of the Surface upon which the Current preſſes might be made greater in the ſmall Ship than in the big one: Or, if our Author

does

does not mean the Quantity of Force, but its Velocity, or *Vis Acceleratrix*, as he calls it, then is this preciſely equal in our Inſtance, for the Water preſſes the great Ship and ſmall with a Force of equal Velocity.

There may be innumerable Inſtances of this kind; ſuch as the ſame Wind which drives unequal Clouds with equal Velocity. A Body of 100 Pound Weight, in a Motion of any given Velocity, ſtriking upon a Body of 10 Pound, and upon another of 50 Pound, will bring theſe unequal Bodies into a Motion of equal Velocity, though it acts upon their Surfaces only, and that with a Force the ſame, both in Quantity and Velocity, *viz.* All the Force and Velocity with which it ſelf moves, for it can give no more Velocity to the ſmalleſt than it has, and it will be able to put the greateſt into a Motion of a Velocity equal to that in which it ſelf moves.

But

But what need we ſpend Time in giving Inſtances of this, ſince all Bodies of unequal Quantity of Matter moving with equal Velocity, (where it appears by what Force they are moved) appear to be moved by Cauſes that act upon their Surfaces only; and almoſt all thoſe Bodies appear alſo to be moved by Forces which are either equal or not in Proportion to the Quantities of thoſe Bodies. So that I proteſt I cannot ſee what has drawn our Author into ſuch a Miſtake, as to infer from the equal Velocity of the Motions of Bodies differing in Quantity, that thoſe Motions muſt be produced by Forces proportionable to theſe different Quantities; and again from that to infer that this Force muſt act upon the whole Subſtance of Bodies. Nor can I ſee how it comes that ever any Man of good Senſe could think that theſe Inferences were fair, or be induced by this Argument to frame an Idea ſo very ſtrange, as that of a Cauſe penetrating

netrating and acting, not upon the Surface, but upon the whole Subſtance of Bodies. But to proceed,

Both our Authors aſſert in ſome of thoſe Propoſitions which I have conſidered, that the Force which turns the Stars in their Orbits, in different Diſtances from thoſe Bodies round which theſe Orbits are deſcribed, is as the Squares of thoſe Diſtances. And this Part of theſe Propoſitions I have not taken Notice of, becauſe I cannot ſay but the Cauſe which turns the Stars in their Orbits may be ſuch; nay, I am inclined to believe it to be ſuch. And therefore though the Arguments our Authors uſe to prove this be very weak, yet it were critiſizing upon thoſe Authors (which I have no Mind to do) rather than handling my Subject, to remark upon thoſe Arguments.

That which concerns my Subject in this Point, is their Aſſertion, that Attraction is ſuch a Force as at different Diſtances is as the Squares

Squares of thoſe Diſtances; becauſe the Proof of this Aſſertion proves their Cauſe to be in that Reſpect like the true Cauſe, and ſo yields ſome Probability of its being the true Cauſe.

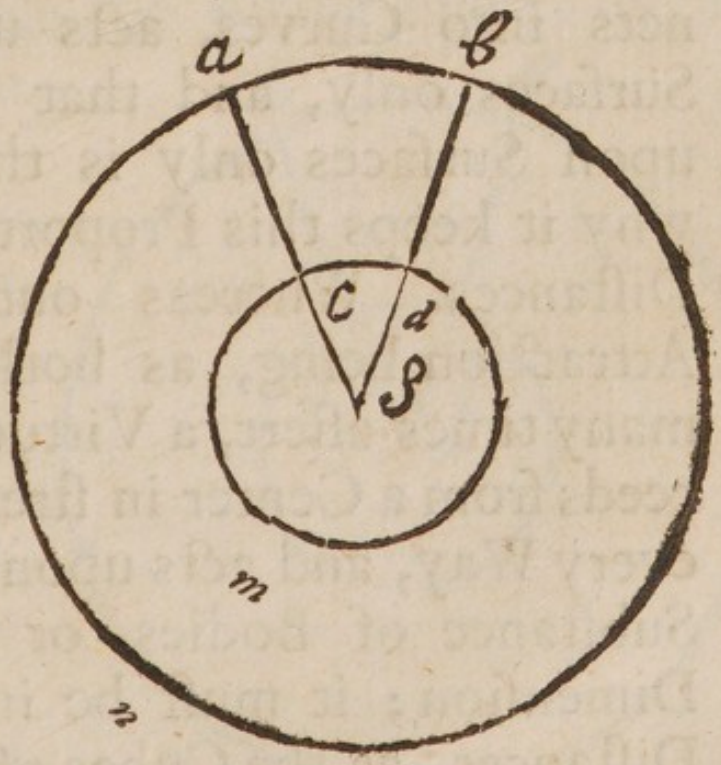
This Point Mr. *Newton* no where proves; but aſſerts or ſuppoſes only; but Dr. *Gregory* proves it Prop. 48. This Propoſition aſſerts,

That the Force or Efficacy of any Virtue (ſuch as Attraction) which ſpreads it ſelf either to or from a Center in ſtreight Lines, through all the Space that ſurrounds that Center, muſt in different Diſtances from the Center be as the Squares of thoſe Diſtances. His Demonſtration is,

It's plain that any Quantity of this Virtue being ſcatter'd equally through a greater Space, and the ſame Quantity being ſcatter'd equally through a leſſer Space, there will be of this Virtue in any given Part of the greater Space a Quantity, which is to the Quantity of it that

is

is in an equal Part of the leſſer Space, as the leſſer Space to the greater. It's plain alſo, that the Force or Efficacy of this Virtue in any two Places, is as the Quantity of it that is in thoſe Places. Let *S* be the Center; deſcribe round *S* the two Spherical Surfaces *a b n* and *c d m*; draw the Lines *aS* and *bS*. The ſame Quantity of this Virtue that is ſpread through the Spherical Surface *c d m*, is alſo ſpread thro' the Spherical Surface *a b n*; therefore in any Part of the Surface *c d m*, the Force of this Virtue is to its Force in an equal Part of *a b n*, as *a b n* to *c d m*; but



a b n is to *c d m*, as the Squares of the Circles *a b n* to *c d m*; which are

as the Squares of the Radij *aS* and *cS*: viz. The Diſtances of the Surfaces *c d m* and *a b n*.

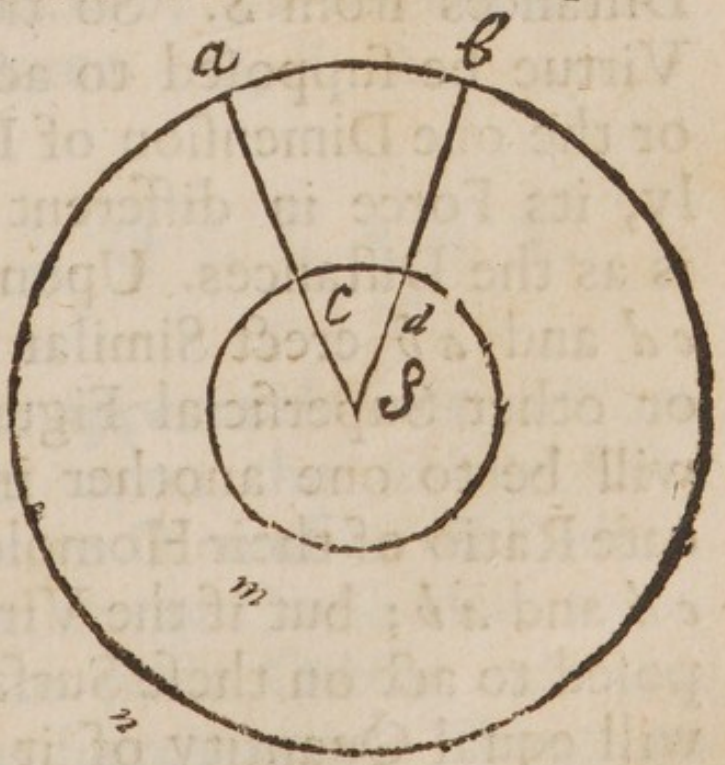
For my part, I believe this Propoſition to be both very true and very fairly demonſtrated of all Virtues that act upon Bodies, and proceed to or from a Center in ſtreight Lines; but then, I believe this, only becauſe I alſo believe that no ſuch Virtue can act upon any more than the Surfaces of Bodies, and that the Cauſe which forces the Planets into Curves, acts upon their Surfaces only, and that its acting upon Surfaces only is the Reaſon why it keeps this Proportion to the Diſtances. Whereas our Authors Attraction being, as both of them many times aſſert, a Virtue that proceeds from a Center in ſtreight Lines every Way, and acts upon the whole Subſtance of Bodies, or their trine Dimenſion; it muſt be in different Diſtances, as the Cubes of thoſe Diſtances, which I ſhall demonſtrate in the following *Theorem*.

THE-

THEOREM III.

The Force or Efficacy of any Virtue, which ſpreads it ſelf in ſtreight Lines through all the ſurrounding Space equally to or from a Center, and acts upon the whole ſolid Content or trine Dimenſion of Bodies, muſt in different Diſtances from that Center be as the Cubes of thoſe Diſtances.

Suppoſe the Virtue that is ſpread to or from the Center *S*, to act upon Lines or the one Dimenſion only, *viz.* the Circles *c d m* and *a b n*:



Since this Virtue comes in ſtreight

Lines, it's plain that the ſame Quantity of it which falls upon the Line *a b*, will alſo fall upon the Line *c d*; becauſe thoſe Arches are intercepted by the ſame ſtreight Lines *a S* and *b S*: And therefore the Force or Efficacy of this Virtue, acting upon equal Parts of thoſe Lines, by our Authors Demonſtration, will be as the Lines which are the Spaces in which the Virtue is ſuppoſed to be ſpread; but theſe Lines *c d* and *a b* are as the Radij *c S* and *a S*, or their Diſtances from *S*. So that if this Virtue be ſuppoſed to act on Lines or the one Dimenſion of Length only, its Force in different Diſtances is as the Diſtances. Upon the Lines *c d* and *a b* erect Similar Triangles, or other Superficial Figures; they will be to one another in a Duplicate Ratio of their Homologus Sides *c d* and *a b*; but if the Virtue is ſuppoſed to act on theſe Surfaces, there will equal Quantity of it be ſpread in thoſe Similar Superficial Figures, and conſequently upon equal Parts

of

thoſe Surfaces the Force of that Virtue will be in a Duplicate Ratio of *c d* and *a b*, which are as the Diſtances of thoſe Surfaces from *S*: (as our Author in his Prop. demonſtrates.) Upon thoſe Superficial Figures, erect Similar Cubical Figures, they will be in a Triplicate Ratio of *c d* and *a b*; and conſequently if the Virtue be ſuppoſed to act in a Cubical Space, or upon the three Dimenſions of Length, Breadth and Thickneſs, its Force muſt at different Diſtances be as the Cubes of thoſe Diſtances. *Q. E. D.*

COROLLARY.

Hence it appears that Attraction, which acts upon the whole Subſtance or trine Dimenſion of Bodies, can neither be the Cauſe that turns the Stars in their Orbits, nor the Cauſe that forces heavy Things to fall to the Ground; nor of any Centripetal Force, which in different

Diſtances is as the Squares of thoſe Diſtances.

Mr. *Newton*, in his 10th Prop. aſſerts, that the Planets may keep their Motions exceeding long without Diminution; which he thus proves.

The Air as it riſes from the Earth's Surface rarifies in a great Proportion; ſo that as high as the Planetary Regions it muſt become exceeding thin; and the Reſiſtance of a Fluid being as its Denſity, the Reſiſtance of that Fluid, which in thoſe Regions is ſo exceeding thin, becomes almoſt nothing.

This Proof is extremely weak, for though it be granted that the Denſity of our Atmoſphere decreaſes in any Proportion Mr. *Newton* pleaſes to aſſert; yet neither he, nor any Body elſe that I know of, aſſerts that this Atmoſphere reaches thro' the Planetary Regions, or that the Planets move in our Atmoſphere; but that they have Atmoſpheres of their own, and that thoſe Atmoſ-

pheres

pheres are a Part of themſelves, that move along with them; as we are ſenſible that our Atmoſphere moves along with our Earth: But what is the Nature of our Atmoſphere, or the Proportion betwixt the Denſity of its Parts to the Fluid (if any be) that fills the Planetary Regions thro' which our Atmoſphere moves? Nay, is it not taken for granted by Mr. *Newton* and his Followers, from the Refraction of the Rays of Light, when falling on our Atmoſphere, that the Fluid of which it is compoſed is different from that Fluid that fills the Planetary Regions? And if ſo, What does the Denſity, or Proportion of Denſity of the one Fluid relate to the Denſity of the other?

Dr. *Gregory* is ſo ſenſible of the Weakneſs of this Demonſtration, that in this Point he forſakes his Guide, and demonſtrates this Propoſition, after a manner quite different, in his 44th Prop. L. 1. He is alſo ſomewhat more bold in aſſert-

ing; for he affirms the Planets to be in their Motions altogether free of Reſiſtance, and that therefore their Motions may continue undiminiſhed. His Proof of this Aſſertion, is this:

The Orbits of the Planets appear to continue the ſame; but if thoſe Bodies met with any Reſiſtance at all, this Reſiſtance, continuing to act upon them in many Revolutions, could not but produce a ſenſible Effect, * and make their Orbits far different from thoſe Eliptick Orbits, in which they appear to move; theſe being the Figures they are demonſtrated to deſcribe, if no Ways reſiſted.

This Proof is thus far preferable to Mr. *Newton*'s, That it follows fairly enough from what they imagine to be proved before, *viz.* That

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* *Si foret vel minima reſiſtantia &c. Planetarum viæ Saltem in Pluribus revolutionibus, immane quantum ab Elipſibus diſcrepare deprehenderentur &c. Nulla eſt ergo &c.*

a Centripetal Force turns thoſe Bodies into Eliptick Orbits; for if the Effect of that Force alone be to turn a Body from a ſtreight Line into an Eliptick Orbit, any other Force alſo acting upon this Body muſt neceſſarily have its full Effect, and in Compoſition with the former, produce a Motion different from what the former alone would do. And its alſo evident that this other Force, if it be at all, is not to be ſuppoſed ſo ſmall as not to produce a ſenſible Effect, when continuing for any conſiderable Time.

Since this Demonſtration is fairly drawn from what is before, I ſhould not have mentioned it, but that it is a very ſtrong Proof of the Abſurdity of our Authors Hypotheſis: For though it be fair Reaſoning, it gives a much greater Proof of the Abſurdity of that Hypotheſis, than the weak Argument with which Mr. *Newton* ſupports his Hypotheſis in this Point. For to draw an Abſurdity by fair Reaſoning from

an Hypotheſis, is to demonſtrate that Hypotheſis to be abſurd; whereas to ſupport an Hypotheſis by weak Arguments, is only to make it probable that the Hypotheſis is falſe.

The Abſurdity that Dr. *Gregory* here demonſtrates from his Hypotheſis is very evident; for if the Planets be abſolutely free of all Reſiſtance in their Motions, then either the Spaces through which they move, are abſolute Voids; or the Bodies with which thoſe Regions are filled, do not react upon the Planets when they force their Paſſage through thoſe Regions. That the Planetary Regions are abſolute Voids, is what I think no Man ever ventured to aſſert, and what I ſhall have Occaſion hereafter to demonſtrate to be abſurd. And I ſuppoſe no Man will deny the Abſurdity of believing that the Bodies (if any be) which fill the Planetary Regions, do not react upon the Planets, when acted upon by the Pla-

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nets, and the Planets muſt neceſſarily act upon them to force their Way.

Mr. *Newton* himſelf ſeems to have been well aware of this Difficulty; for he appears not ſo much ſtreightned in any Point as in this, which we may eaſily ſee by the extravagant Accounts he makes up of the Thinneſs of that Ætherial Fluid, which fills the Planetary Regions, drawn from the Hypotheſis of a Diminution of Denſity in the Fluid that lies betwixt the Surface of the Earth and the Planets, continuing in the ſame Chain of Proportion, that begins near the Surface of the Earth in our Atmoſphere; and that the whole Column of this Fluid is equal in Quantity to a Column of Water 33 Foot high: Which two Hypotheſes he repreſents as certain; and from them * calculates that the Denſity of this Fluid, at the Di-

* *Prop.* 41. *L.* 1.

ſtance

ſtance of one of the Earth's Semidiameters from the Surface is ſo ſmall, that as much Fluid of that Denſity as would fill a Sphere as wide as the Orbit of *Saturn*, would not contain ſo much Matter, as the Quantity of Matter contained in ſo much of our Air upon the Surface as is comprehended within a Spherical Space of an Inch Diameter. And if this be true, this Fluid at the Diſtance of ſo many Semidiameters as the Planets are removed from us, will be ſo thin, that no Reſiſtance that is ſenſible could have been expected from it in a much longer Time than ſince the Creation of the World. And to ſay truth, I think Mr. *Newton*'s Way of acknowledging the Planets to be reſiſted in their Motions, is as reconcileable with their continuing to deſcribe the ſame Orbits without any Diminution of their Motion, as Dr. *Gregory*'s Way of denying that Reſiſtance. And therefore I think the Shift he elſewhere makes was needleſs; where

where he tells us that the Motions of the Planets are really ſomewhat diminiſh'd, as he ſays a late Aſtronomer has found out, by comparing the Calculations of their periodical Times now, with thoſe of the ancient *Babilonian* Aſtronomers. He might as well have ſaid that the Planets (at leaſt the Earth) have ſomewhat increas'd their Motion, from comparing the Calculation of the Aſtronomers in Pope *Gregory*'s Time, with the Calculations of thoſe in *Julius Cæſar*'s Time.

It's ſtrange that the one of our Authors ſhould demonſtrate an Abſurdity from their Hypotheſis, and the other have Recourſe to ſuch ſtrange Shifts, for reconciling it with the Continuance of the ſame Quantity of Motion which is obſerved in the Planets; ſince their Hypotheſis will account for nothing ſo well, as for a Supply of Motion to ballance Reſiſtance and keep up the Stock. Certainly it is not the Fault of that Hypotheſis, that according

cording to it there must be a Diminution of the Motion of the Planets; for if our Authors could but account for the Direction in which the Planets move from their Cause, and keep them from gathering together in a Cluster, (which they must certainly do, if constantly attracting each other) I should help them out of this Difficulty, and shew from their Hypothesis a plentiful Supply of Motion, for keeping up the Stock against Resistance.

If we suppose the Planets to move in Circles, then is the Force of Attraction in the Direction of the Radius, and the Force with which the Body endeavours to run out in the Direction of the Tangent of those Circles. But the Tangent and Radius of a Circle are always at Right Angles; and a Body moved by two Forces meeting at Right Angles, must move with a greater Velocity than the Velocity of any of those Forces: So that the one of those Forces, *viz.* the Force with which

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the Body endeavours to run out in Tangents, being equal in Velocity to the Velocity in which the Body moved the Inſtant before; and leſs than the Velocity in which it is forced by theſe two Forces to move the next Inſtant, *viz.* as the Side of a right-angled Parallelogram to its Diagonal. A Body moved by two ſuch Forces muſt accelerate its Motion every Inſtant or continually; ſo that its Motion in any Inſtant muſt be to its Motion the Inſtant before, as the Diagonal of a right-angled Parallelogram to one of its Sides.

If the Orbits of the Planets be conceived to be Elipſiſes and not Circles, the Increaſe of Motion will be the ſame: For though all the Tangents of an Elipſis are not at Right Angles with the Radij, drawn to one of the Foci, yet there are as many of them at leſs than Right Angles with thoſe Radij, as there are at more than Right Angles; and thoſe that are at leſs, are at juſt as much leſs than Right Angles, as

thoſe

thoſe that are at more, are at more than Right Angles with the Radij, drawn to that Focus. So that whatever leſs Increaſe of Motion there is in one Part of the Elipſis, than there would be if it were a Circle, there is as much greater Increaſe in another Part of that Elipſis: So that if the Sum of the Increaſe of Motion of a Body moving by ſuch Forces, in its performing one full Revolution in an Eliptick and in a Circular Orbit, be compared, they will be found exactly equal.

Here is a plentiful Supply of Motion from our Authors Cauſe, ſo that they need not have Recourſe to ſuch hard Shifts as they make uſe of to palliate this Matter; nay, if this Increaſe be duly conſider'd, I am afraid it will rather be more than our Authors will have Occaſion for, and put them upon as hard Shifts to find Reſiſtance enough for the Planets, as now they are to clear them of Reſiſtance. So that I can hardly tell whether they had not as

good

good be without this Diſcovery; eſpecially conſidering that the Reſiſtance of a Fluid that would then be neceſſary would, according to our Authors themſelves, force the Planets into Spiral Lines; and this would make the Remedy worſe than the Diſeaſe; ſo that they had better be without this Increaſe of Motion, which I have found out for them. But how can they be without it? For nothing is more certain than that the Motion of a Body moving in an Elipſis by one Force in the Direction of all the Tangents of that Elipſis, and another in the Direction of all the Radij, drawn to one of the Foci of that Elipſis, muſt be encreaſed, if ſomething do not deſtroy this Motion, as faſt as theſe Forces meeting in that manner will increaſe it. So that it's abſolutely neceſſary for thoſe, who believe the Planets to move in Eliptick Orbits by a Centripetal Force, to find out ſomething to check this exuberant Motion; and for my part, I

can ſee nothing ſo fit for this Uſe as the ſolid Spheres of the Ancients: For thoſe would hinder the Stars from moving in Spiral Lines, and running together; which, as I have already demonſtrated they muſt do, if moved by our Authors Centripetal Force; and in hindring them from running into Spiral Lines, would check the Exuberance of their Motion, and keep them all in good Order. In ſhort, I ſee nothing ſo fit to be joyned with our Authors Hypotheſis, as that of ſolid Spheres; and ſure I am, thoſe Hypotheſes are in ſome Reſpect not unfitly coupled together.

There are ſome very conſiderable Objections that may be made againſt our Author's Account of the Cauſe of the heavenly Motion which he foreſees; one of which he obviates with abundance of Art in his 11th Prop. The Objection is, that if the Sun and Planets mutually attract each other, then muſt the Sun be moved by the Attraction of the Planets,

nets, as well as they by the Attraction of the Sun. But it is agreed upon by all Philoſophers, that the Center of our Syſtem is fix'd, and now no Man of Learning queſtions that the Sun is this Center.

Our Author obviates this Objection, by aſſuming the Hypotheſis, that the Center of the Syſtem of the Univerſe is fix'd, which he knows no Man will deny; and inferring from that Hypotheſis, that the Center of our Syſtem is alſo fix'd. And again, from this Inference proving that the Sun is not the Center of our Syſtem; but an imaginary Point, which he calls the common Center of Gravity of all the Bodies of which our Syſtem is compoſed; and by this Means he takes the Liberty to ſet the Sun (which according to him is not the Center of our Syſtem) in Motion, in his 12th. Prop.

The other Objections of the ſame Nature with this, he does not in this Place meddle with; ſuch as that which forces him to own that

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the Earth does not perform its Orbit round the Sun, nor ſo much as round that imaginary Point which he will have to be the Center of our Syſtem; but that the Center of Gravity of the Earth and Moon, one imaginary Point, deſcribes an Orbit round the Center of Gravity of our Syſtem, another imaginary Point. Theſe Objections were not quite ſo evident as this he here obviates, and even this he touches very ſlightly; for he tells us not here what ſort of Motion the Sun performs; but only extenuates the Abſurdity as much as poſſible, by producing ſome extravagant Accounts of the Quantity of Matter contained in the Body of the Sun, drawn from his own Principles in his own Method. But what he ſays for fully obviating theſe Objections, he does in his firſt two Books, where he treats of Motions in the Abſtract: For it is not ſo ſhocking to hear that *S* is ſuppoſed to move round ſome other Letter, as to be told in plain Terms

that

that the Sun deſcribes an Orbit round an imaginary Point; nor to hear that *t* deſcribes not its Orbit round *S*, but that another Letter beſides *t* deſcribes this Orbit; as to hear it poſitively affirmed of the Earth, that it deſcribes not an Orbit round the Sun.

All I have to ſay to theſe Things is, that it appears evidently that our Author in this neither proves any Phænomena of Nature to proceed from his Cauſe, nor accounts for any of thoſe Phænomena from his Cauſe; but inſtead of that, makes Phænomena that do not appear, to fit his Cauſe; becauſe it will not fit thoſe Phænomena that do appear, which for that Reaſon he lays aſide. And in my Opinion this Management is ſo far from ſtrengthening his Hypotheſis, that it rather weakens it: For to me it ſeems the livelieſt Proof that can be of the Abſurdity of our Author's Cauſe, when we ſee him obliged to new-model Nature, to make it agree with

with his Cauſe, becauſe his Cauſe will not agree with Nature.

Our other Author Dr. *Gregory* does not cover ſo well from View this Difficulty, which they are put to in managing their Subject: For he propoſes and accounts for from his Cauſe, all thoſe fictitious Phænomena almoſt without diſguiſe in his 8th and 9th Sections, L. 1. And if any Man do but impartially conſider how that Author is forced to diſtort the Simplicity of Nature, to fit it for his Cauſe, he will ſee the livelieſt Repreſentation imaginable of the hard Neceſſity which Men are put under, (by being obliged to be conſiſtent with themſelves,) when in Phyſicks they advance an Abſurdity; for in Conſequence of one that they have advanced, they are obliged to advance a whole Chain of Abſurdities.

Mr. *Newton*, in his 13th Prop. tell us, that ſince he has diſcovered what Cauſe it is that produces the heavenly Motions, he may now demonſtrate

monſtrate *a priori*, what ſort of Motions the heavenly Bodies perform, *viz.* demonſtrate Mathematically what Motions his Cauſe muſt produce. So that the Phyſical Part of his Subject is now over, and theſe Demonſtrations of the Effects of his Cauſe, are purely Mathematical, and relate no Ways to Phyſicks, if it be true that this Cauſe of the heavenly Motions, which he pretends to have diſcovered, is not the true one, which I think I have made appear: And ſo what follows in our Authors 3d Book does not concern my Subject. And yet I ſhould alſo remark upon theſe Arguments, and ſhow that they are rather worſe than thoſe I have remark'd upon; were it not that to lay open fairly and fully the Fallacies of thoſe Arguments, would oblige me to lay open the other two Books alſo, with which they are connected; and this were to write a great Volume upon a Subject, which to me ſeems not worth ſo much Labour, as the writ-

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ing It would require ; and I believe moſt Readers would hardly think it worth Reading over. So that I ſhall content my ſelf with telling my Reader in general what ſort of Arguments thoſe are, by which he proves from his Cauſe what the Motions of the Planets muſt be.

He knows from the beſt Obſervations, that Aſtronomers have hitherto been able to make, what are the real Motions of the Planets; and thoſe which he thus comes to know to be the real Motions of thoſe Bodies, he (Right or Wrong) demonſtrates that his Cauſe muſt neceſſarily produce.

I ſhall juſtify this Charge againſt our Author, without entering upon a nice Diſcuſſion of his Arguments, by an Inſtance of the moſt conſiderable of the Planetary Motions, about which, not only moſt of his Arguments, but moſt of the Study of all thoſe who contemplate this Subject, are employ'd; I mean the Motion of the Moon.

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If that Planet move by the Attraction of the Earth and Sun, and by an Endeavour to run out in ſtreight Lines, it's plain that when ſhe is moving toward her Conjunction, the Attraction of the Sun muſt be in the ſame Direction with the Moon's Endeavour to run out in Tangents, and encreaſe that Part of the Cauſe of her Motion ſtill, till ſhe comes to her Conjunction; and there when this Endeavour is moſt encreaſed, the other Force by which ſhe is attracted to the Earth, and kept from running out in Tangents, is Weakeſt: *viz.* The Attraction of the Earth— the Attraction of the Sun; the Sun's Attraction being juſt of a contrary Direction at that Time to the Attraction of the Earth.

But it's plain that a Body moved by two Forces together, muſt incline moſt to the Direction of that which is moſt powerful, and leaſt to the Direction of that which is leaſt powerful. So that the Moon's Orbit, when in her Conjunctions, muſt

partake moſt of the Tangent Direction, or be leaſt incurved toward the Earth, and ſo be moſt diſtant from it.

By the ſame Way of Reaſoning, the Moon, when moving toward her Oppoſition, has her Endeavour of running out in Tangents diminiſh'd by the Attraction of the Sun till ſhe arrive at her Oppoſition, and then is attracted to the Earth by the Attraction of the Earth + the Attraction of the Sun; and ſo by the foregoing Reaſoning, her actual Motion muſt approach neareſt to the Direction of that which is moſt prevalent in its Compoſure, *viz.* the Force by which ſhe is attracted to the Earth; which being iucreaſed, and the other Force diminiſhed, the Moon muſt then become neareſt to the Earth.

It's very obvious that this muſt be the Figure of the Moon's Orbit, that our Author's Cauſe will produce; and if any Man pleaſe to go more nicely to work, and calculate how much

much farther the Moon muſt be from the Earth in her Conjunctions than at any other Time, and how much nearer in her Oppoſitions, upon our Author's Principles, he will find the Odds very conſiderable. But for my part, I deſign to meddle with no ſuch Calculations, and think it ſufficient to ſhow in general, that in this moſt conſiderable Part of the Figure of the Moon's Orbit, our Author's Cauſe would demonſtrate a Figure quite different from the real One which appears. And ſince he demonſtrates the real One, it's plain his Demonſtration cannot be ſound; and that Obſervation has directed him in drawing the Concluſion of that Demonſtration, rather than fair reaſoning from his Principles.

This conſiderable Inſtance is ſufficient to juſtify what I aſſerted of the reſt of our Author's Demonſtrations; and may be the eaſier taken for a full Proof of that Aſſertion, ſince that Part of them upon which

I have remark'd, appear to be fallacious; or if any Man is not ſatisfy'd with this, let him examine thoſe Arguments himſelf, and he will find them to be ſuch.

Both our Authors, when ſpeaking of the Comets, ſpeak leſs poſitively of the Nature and Cauſe of the Motions of thoſe Bodies than of the Planets; and what they ſay is no more than to ſuppoſe them to be moved by their Univerſal Cauſe in Parabolas; whereas ſome of the beſt of Aſtronomers, from Obſervation, affirm them to move in ſtreight Lines. But to do our Authors Juſtice, the Sides of thoſe Parabolas, in which they will have them to move, differ very little from ſtreight Lines; and I am inclin'd to believe that the Lines thoſe Bodies do really deſcribe, differ as much from ſtreight Lines as thoſe which our Authors ſuppoſe; though I can ſee no other Reaſon for thinking thoſe Lines to be ſome of the Conick Sections, but that by this Means they

they are the more manageable and fit for our Authors Purpoſes.

But that which appears ſtrange to me, is that thoſe Comets moving toward the Sun in a Direction ſo near to a ſtreight Line, as our Authors acknowledge, and at the ſame Time attracted by the Sun, do not fall upon it. Certainly the Direction of their Motion, according to all Authors, is not ſo far directed from the Sun, but that ſo ſtrong an Attraction as the Sun, in our Authors Way of reckoning, muſt have at ſo ſmall a Diſtance, would neceſſarily force them into a Direction ſtreight to it; or if it could not force the Comet into a Line directed exactly to the Center of the Sun, yet ſure the Body of the Sun is not ſmall, but extends a great Way beyond that Point on all Sides; and it's ſtrange the Comets do not fall foul of it in ſome Place or other.

Our Authors are ſo full of the Fancy of their having demonſtrated

that their Attraction can force a Body into a Curve, that they forget entirely the Natural Effect of Attraction, to make one Body move to another; they think a Body that is attracted can never fail to move in ſome of the Conick Sections, elſe ſurely they would have endeavoured to help their Cauſe in the critical Juncture of a Comet's Perihelium, where it ſtands ſo much in Need of their Aſſiſtance, to keep the Comet from falling foul of the Sun.

There remains yet another of our Author's Demonſtrations, which I muſt not omit to conſider, *viz.* his Demonſtration that the Ebbing and Flowing of the Sea, is produced by the Attraction of the Sun and Moon; which is in his Prop. 24. L. 3.

This Demonſtration conſiſts of a long Narration of the Inequalities of the Tides in different Times, Places, *&c.* ſhowing all along ſome Agreement betwixt the Alterations of

of the Tides, and the different Poſitions of the Sun and Moon, and eſpecially of the Moon; ſtill ſuppoſing the Tides and their Alterations to proceed from the Attraction of the Luminaries, attracting differently according to their Diſtance, or other Circumſtances. And ſince there is nothing in this Propoſition but Aſſertion, I ſhall in Anſwer to it aſſert, that I believe the Moon to have an Influence upon the Tide, but not the Sun; and that the only Reaſon for thinking the Sun to have ſuch an Influence, as our Author aſſerts, is becauſe the Temperature of the Air has an Influence upon the Ebbing and Flowing of the Sea, and the Sun or the Seaſons of the Year have an Influence upon the Temperature of the Air. That it is this Difference in the Air which immediately affects the Sea, is well known to all who obſerve its Tides, which are as unconſtant as the Weather, and riſe very differently at times, when the Luminaries are the

ſame Way placed; neither is this to be accounted for always from high Winds at Sea, driving the Water toward the Shore, or from any ſuch Cauſe.

But if it were true that the Tides did ariſe by ſome Influence of both Sun and Moon; What is that to our Author's Cauſe, unleſs he can ſhow that the Attraction of thoſe Luminaries, is that Influence by which this Effect is, or at leaſt may be produced; which he ſuppoſes only and endeavours not to prove? I ſhall however, for full Satisfaction in this Point, ſuppoſe all to be true that our Author aſſerts in this Propoſition, for perſwading People to believe the Ebbing and Flowing of the Sea, to be the Effect of the Attraction of the Sun and Moon, *viz.* that thoſe Attractions can raiſe two Protuberances in the watry Part of our Globe, one under the Moon, and the other upon the oppoſite Side of the Globe, and ſo turn the whole Waters into the Figure of a Spheroid;

roid; and that the Sun and Moon can by their Artractions vary the Shape of this Spheroid, as our Author will have it, by their different Poſitions. And all this being ſuppoſed, I ſhall demonſtrate that the Ebbing and Flowing of the Sea, cannot poſſibly be the Effect of his Cauſe, ſince I ſhall in the following *Theorem* prove, that it muſt be different from what it appears, if produced by that Cauſe.

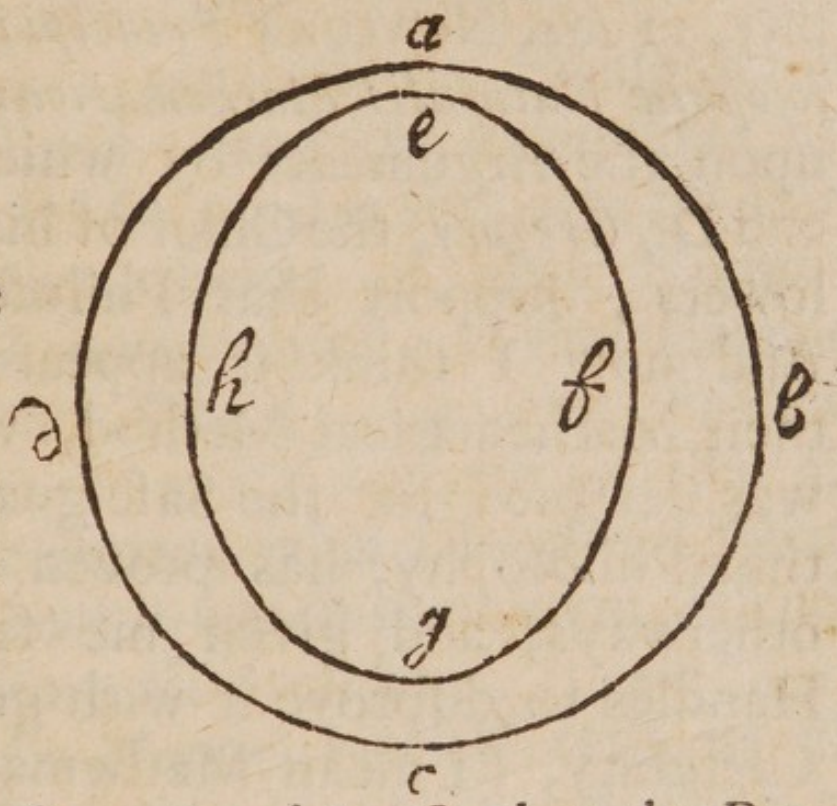
THEOREM IV.

If the Moon draw the Waters of the Sea by her Attraction, ſo as to make two Protuberances of Water, the one under her, and the other diametrically oppoſite to that, or turn the whole Waters to the Shape of a Spheroid; and if theſe Protuberances be varied by her different Situation, or by the Attraction of any other Body acting upon the Waters alſo; yet Ceteris Paribus, *that Protuberance of the Water which is*

under the Moon, will be conſiderably higher in Reſpect of the Dry-Land, than the Protuberance which is upon the oppoſite Hemiſphere.

Let the Circle *a b c d* repreſent the dry Land, and the Spheroid *e f g h* the Waters brought into that Figure by the Moon's Attraction: Suppoſe the Moon to be above the Protuberance of the Waters at *e*. Though *g* be alſo ſuppoſed to be a Protuberance, yet the Waters at *g* are preſs'd to the Earth's Center with the ſtrongeſt Attraction, *viz.* by the Attraction of the Earth + the Attraction of the Moon; whereas the Waters at *e* are preſs'd to the Earth's Center by the leaſt Attraction, *viz.* the Attraction of the Earth— the Attraction of the Moon, and ſo gravitate leſs than the Waters at *g*. The Waters alſo at *f* and *h* are drawn toward *e*, and not toward *g*; beſide the Waters at *g* being moſt preſs'd by Attraction, will run toward thoſe low Places *f* and

and *h*, whereas the Waters at *e* will not, both becauſe they are leaſt preſſed, and becauſe it is toward *e* that the Waters come from *f* and *h*; ſo that the Protuberance at *e*, or rather the whole Spheroid *efgh*, however otherways it be attracted, yet *Ceteris Paribus*, it muſt come nearer to the Point *a*, in the immoveable Circle *abcd*, than to the Point *c*; ſo that the Tide at *e*, which is under the Moon, (ſince the Moon's Attraction is moſt conſiderable) muſt riſe higher in reſpect of the Land, than the Tide at *g*, which is upon the oppoſite Hemiſphere, contrary to Appearance. *Q. E. D.*



I have now remark'd upon all that can be call'd Natural Philoſophy, in *Mr.* Newton's *Principia Philoſophiæ Naturalis Mathematica*; and upon the Arguments by which he and Dr. *Gregory*, the Chief of his Followers, ſupport that Philoſophy. And now I think it appears that their Mathematical Method, which was deſigned for the Safe-guard of that Philoſophy, has proved quite otherways, and given me ſeveral Handles to diſprove it with greater Certainty, (I mean Mathematical) than I could otherways have done. I think it appears alſo how unfit the Mathematical Method is for proving the dark Points of Natural Philoſophy. Mathematical Demonſtrations, when built upon the ſure Foundation of Mathematical Principles, are like Houſes of great Weight and Solidity, which are built upon a rocky Foundation, and are not eaſily overthrown; whereas he who builds the Superſtructure of a Mathematical Demonſtration upon

on the weak Foundation of the Uncertainties in Natural Philoſophy, does the ſame Thing as he who builds a great ſtrong Houſe upon the Sand. And the Arguments by which Mr. *Newton* ſupports his Philoſophy, being of that Nature, could never have ſtood their Ground in the World, for the ſmalleſt Time, had it not been for that almoſt impenetrable Cloud of Obſcurity, with which they were defended from all Attacks.

Mr. *Newton* himſelf tells us almoſt plainly in his Introduction to his 3d Book, that he deſigned thus to defend his Philoſophy from the Attack of Diſputants.* He ſays

* *In libris precedentibus principia Philoſophiæ, tradidi non tamen Philoſophica ſed Mathematica tantum &c. de Mundi Siſtemate compoſueram librum tertium methodo populari, ut a pluribus legeretur, ſed quibus principia poſita ſatis intellecta non fuerint, ii vim conſequentiarum minime percipient, neque prejudicia deponent quibus a multis retro annis inſueverint; & propterea ne res in Diſputationes trahatur ſummam libri illius tranſtuli in propoſitiones more Mathematico, ut ab iis ſolis legantur, qui principia prius evolverint &c.*

that

that his Philoſophy being very inconſiſtent with Mens Ways of thinking, leſt they ſhould call it in Queſtion, he had not propos'd it in the common Method; but put his 3d Book, which contains his Philoſophy, in ſuch a Method, that no Man ſhould be able to underſtand it, without firſt underſtanding the two former Books that were Mathematical; and conſequentlty could not impugn it, till they had firſt diſcuſt thoſe two Books. And the Difficulty there is in underſtanding, and much more in impugning thoſe two Books, with which our Author thus guards his Philoſophy, is very well known to the Learned World. By this Management, Mr. *Newton* put almoſt every Body beyond a Poſſibility of diſputing his Philoſophy; and the World have hitherto received this Philoſophy, as they did of Old the Dictates of their Magi, or the Reſponſes of their Oracles, without knowing the Meaning of what was impoſed upon them,

them, or the Reaſon of what was ſaid to them; which if they had done, thoſe Dictates and Reſponſes were generally ſuch, as they would have deſpiſed. And I am perſwaded had Mr. *Newton*'s Philoſophy been propoſed in ſuch a manner as to have been generally underſtood, it would have had the ſame Fate; and that the Reaſon of its being treated with ſo much Reſpect, was the ſame with that which made the *Heathens* honour ſo much thoſe pitiful Equivocations of their Prieſts.

Since I have removed thoſe Outworks, by which that Philoſophy has hitherto been rendered inacceſſible, I ſhall make bold with it, and propoſe it barely without any Diſguiſe to the Eyes of the World, who, when they behold it in that manner, will (I am perſwaded) have as ſlender an Opinion of it, as of any of the moſt exploded Schemes of the ancient Philoſophers.

Mr.

Mr. *Newton* tells us, that * every the leaſt poſſible Particle of Matter, or Body, attracts all Bodies at † all Diſtances; that the Being, whatever it is, that performs Attraction, or puſhes Bodies toward each other, proceeds from thoſe Bodies to which it belongs, and penetrates the whole Subſtance of thoſe Bodies upon which it acts. Dr. *Gregory* tells us, †† that the Virtue, as he calls it, which performs Attraction, is like light Heat, *&c.* ſpread from a Center every Way through the ſurrounding Space equally; ſo that when ſpread through a larger Space, it is leſs in any part of that Space, becauſe more dilated (*Diffuſa & Sparſa* as he expreſſes it,) and when ſpread through a leſſer Space, there is more of it in an equal Part of that Space, becauſe there it is more pent up, (*Conſtipata*) and that the Quan-

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* *Prop.* 6, 7 and 8. *L.* 3.

† *Page* ult.

†† *Prop.* 48. *L.* 1.

tity

tity of this Virtue that is contained in any Part of a greater Space, is to the Quantity of it that is contained in an equal Part of a leſſer Space, as the Spaces.

From theſe Accounts, I think, it were unjuſt to ſuppoſe that thoſe Authors deſign to ſay, that Attraction is the immediate Action of thoſe Bodies that are ſaid to attract; for it is not to be thought that they could be guilty of Abſurdities ſo groſs as are included in ſuch an Aſſertion, *viz.* to ſay that Bodies act immediately or by themſelves, without the Intervention of any other Being, in a Place where they are not; that they thus act in many Places at the ſame time; that they proceed from themſelves; that they penetrate each other; that the leaſt Particle of Matter is extended as far as the Limits of the Univerſe, *&c.* It were, I ſay, the higheſt Injuſtice done to our Authors, to ſuppoſe that they mean to aſſert Bodies themſelves to be the immediate Agents in

in performing their Attraction, ſince of that which is the immediate Agent, they aſſert what I have mention'd. So that whatever it is that performs Attraction, it muſt be ſomething different from the attracting Body; and, ſince *agere ſupponit eſſe*, it muſt be a real Being.

Let us then conſider what is ſaid of this Being, which is the Inſtrument of Attraction. It proceeds from the ſmalleſt poſſible Particle of Matter equally all around, and extends as far as the Limits (if any be) of the Univerſe; ſo that to every Particle of Matter there belongs a Sphere of this Being as big as the Space or Extent of the Univerſe. The Quantity of this Being that is pent up in any part of thoſe Spheres near their Center, is to the Quantity of it which is in an equal Part near the Surface, in a Duplicate, or rather Triplicate Proportion of the Diſtances of thoſe Places from the Center of the Sphere; and yet ſince this Particle attracts

every

every other Particle in Nature, there muſt not be the leaſt Pore in this Sphere, even near its Surface, where the ſmalleſt Particle of Matter could be free of its Influence; nay, this Being muſt fill even the moſt diſtant Spaces ſo perfectly, as to penetrate the whole Subſtance of thoſe Bodies which occupy any of it, tho' but equally ſpread.

Since every the leaſt Particle of Matter muſt have belonging to it, ſuch a Sphere as I have deſcribed, it's plain, that every one of thoſe Spheres muſt penetrate each other, as well as they do Bodies; and if Matter be diviſible *in infinitum*, there muſt be an infinite Number of ſuch Spheres; or if the Doctrine of Atoms be true, yet the Number of thoſe Spheres will be ſufficiently great.

This extravagant Number of Spheres, of ſo enormous Bulk, and made up of a Being of ſuch a ſtrange Nature, is that by which, according to the *Newtonian* Philoſophers, ſome

ſome of the moſt conſiderable Phænomena of Nature are performed. And who would think (when he hears with what Contempt thoſe Philoſophers treat good old *Ariſtotle*, for attributing the Secrets of Nature, which he could not diſcover, to occult Qualities) that thoſe mighty Philoſophers themſelves had recourſe to ſuch an occult Cauſe as this; or who would believe, that they who receive nothing in Philoſophy but what is proved by Experiment and Demonſtration, who reject with Diſdain the Cauſes conjectured by their Predeceſſors, *viz.* Spirits, or Second-rate Divinities, Qualities, Principles, and ſuch like, were themſelves framing Chimera's for producing the ſame Effects, of a much more ſtupendous Nature, than any one of the Fictions of their Predeceſſors? Certainly no Cauſe that ever was aſſigned by any Set of Philoſophers, for the Production of any Effect, was ever ſo ridiculous as thoſe Spheres; and if they had been

been propoſed to the World in that ſame plain undiſguiſed manner that other Philoſophers have propoſed their Conjectures, they would never have been received; and nothing but the ſhew of Mathematical Demonſtration, together with the Obſcurity with which this Scheme of Phyſicks was veil'd, could have prevented its being hiſs'd off the Stage at its firſt Appearance in the World.

After having conſidered this Philoſophy, as it muſt have appeared to the Imagination at firſt View, if it had been propoſed in the common ſimple Method, in which Natural Philoſophy has always been propoſed; let us next ſee how it muſt have appear'd to the Underſtanding, upon Reflection.

That Reflection upon this Philoſophy which to me ſeems readieſt and moſt natural, is its Repugnance to the Simplicity of Nature, and the Wiſdom of its great Author. For nothing appears more clearly in this

this Philoſophy, than the vaſt Multitude and confuſed Complication of Cauſes ſuppoſed, for producing a few plain Effects; and nothing appears more clearly in Nature, than the Multiplicity of great and ſtupendous Effects, proceeding from few and plain Cauſes. And it is this very Appearance in Nature, wherein we trace the cleareſt Footſteps, not only of Council and Deſign, but of infinite Wiſdom in the Author of Nature: For to do what one deſigns by the ſhorteſt, ſtreighteſt, and ſimpleſt Means, is the ſure Mark of Wiſdom; whereas to do a great deal more than is needful for bringing about one's Deſigns, is a certain Mark of Folly and Ignorance. And if ſo, how unlike is it to the Simplicity of Nature, and the Wiſdom of its Author, to have ſo great a number of ſuch immenſe Spheres, made up of a Being of ſo extraordinary a Nature, for cauſing Seventeen Spherical Bodies to roll in uniform Orbits, and the Parts of

thoſe

thoſe Bodies to keep together; which is all that theſe Spheres are contrived for by the *Newtonian* Philoſophers? Certainly this is turning Nature upſide down, and placing in it Marks of as great Folly and Ignorance in its Author, as there really are in Nature Marks of his Wiſdom and Diſcretion: For here is a ſtupendous multiplicity of Cauſes made uſe of to produce a few plain and ſimple Effects, inſtead of a multitude of Effects proceeding from a few plain and ſimple Cauſes; which is always obſerved to be the Order of Nature.

The Reflection upon this Philoſophy that ſeems next to preſent it ſelf to our Mind, is the Inconſiſtence of the Nature of that Being, of which thoſe prodigious Spheres (the Inſtruments of Attraction) are made up, according to the Accounts we have of the Nature of that Being from our Authors. * They

* *In immenſas Diſtantias undique extenditur. pag.* ult. *Prin.*

tell

tell us, that this Being exiſts in a Place ſeparate from that Body to which it belongs, and there acts ſo that it muſt be a Subſtance. † They tell us alſo, that it is dilated in a greater, and compreſs'd and cloſely pent up in a leſſer Space; and that its Quantity in any Parts of thoſe Spaces, is as the Spaces. And from this relation betwixt the Quantity of this Inſtrument of Attraction, and the Quantity of the Space in which it is contained, it appears to be ſomething that is extended; and an extended Subſtance is Body or Matter. So that this Account we have of the Nature of the Inſtrument of Attraction, is equivalent to an Aſſertion that it is compoſed of Body; and from hence a whole Cluſter of Abſurdities follow, *viz.* this Inſtrument of Attraction, which extends to and fills all Places, muſt ſo fill all Space, as to leave no

† Prop. 48. l. 1. *Greg. Aſtro.*

Void,

Void, or no Space that is not filled with Body, though our Philoſophers themſelves be the greateſt Aſſerters of a Void of all other Sects, ſince their Philoſophy requires the whole Planetary Regions to be almoſt or rather altogether void.

From this it alſo follows, that Body penetrates Body; for we are told that this Inſtrument of Attraction penetrates Bodies: nay, it here follows, that every Body is penetrated by as many different Bodies at once, as there are Particles of Matter in the Univerſe, ſince every Particle of Matter has its Inſtrument of Attraction.

But the greateſt Abſurdity that ariſes from this Reflection is, that every Particle of thoſe Spheres that are the Inſtruments of Attraction, muſt alſo attract; becauſe according to our Philoſophers all Bodies attract; and conſequently every Particle of thoſe Spheres muſt have a whole Sphere belonging to it, to

be the Inſtrument of its Attraction; and ſo *in infinitum*.

Though the ſhowing that theſe Abſurdities follow from the *Newtonian* Philoſophy, be as good Proof of its Falſhood, as any that can be drawn from the Principles of Natural Philoſophy; yet I have not ſhowed thoſe Abſurdities, as if I imagined my ſo doing to be a Proof of the Falſhood of that Philoſophy, of ſuperior or ſo much as of equal Evidence and Certainty with thoſe Demonſtrations, by which I haveal-ready Mathematically demonſtrated this Philoſophy to be falſe; or as if I thought that thoſe Demonſtrations ſtood in Need of any additional Proof to ſtrengthen them. My Deſign in giving this ſhort View of the Abſurdities that may be drawn from the *Newtonian* Philoſophy by Phyſical Reaſoning, was only to ſhow the Abſurdities of that Philoſophy, to thoſe who are not ſo well acquainted with Mathematicks, as to gather

ther them from my Mathematical Demonſtrations, where they appear to the greateſt Advantage.

I HAVE now (I think) fully diſproved the *Newtonian* Philoſophy, to the Satisfaction of every judicious Reader; and after all, in ſo doing, I have only ſhow'd that Sect of Philoſophers to be miſtaken in a Matter which has deceived all other Sects of Philoſophers, as well as them; and that their Maſter has not diſcovered the Thing that never Man was able to find out. I have only made appear that they have not hit upon the true Cauſe of the Motions of the heavenly Bodies, and ſo ſet this Philoſophy upon a Level with all others. I ſhall next remark upon ſome Faults peculiar to this Philoſophy, that it may be judged of in Reſpect of other Schemes of Philoſophy, to which this is ſo generally preferred.

It is obſervable of the *Newtonian* Philoſophy, that it is advanced with

a greater Shew of Certainty than any other; and that what it propoſes to our Belief, is not propoſed as moſt Parts of Natural Philoſophy ought to be, *viz.* as probable, but as abſolutely certain and mathematically demonſtrated. And ſince this Philoſophy is as falſe as any other, it's plain that it is the more to be found Fault with, by how much the greater Shew of Certainty it carries. For every Body knows that he who advances a Falſhood, the more poſitive he is, and the greater Aſſurance he ſhows in Advancing it, the more he Errs: And that any Man who takes a Proof, which has no manner of Strength in it, for abſolute Demonſtration, is more groſſly deceived by that Proof, and is a worſe Judge of Reaſoning, than if he had taken that Proof for probable Reaſoning only. And if this be true, as it certainly is, the *Newtonian* Philoſophers have erred more groſſly than any other Sect, and have judged more

amiſs

amiſs of the Reaſons upon which they grounded their Belief.

But let us lay aſide the Manner in which this Philoſophy is propoſed, and conſider the Philoſophy it ſelf.

It contains no more, but that Part of Phyſicks which concerns the Syſtem of the Univerſe; which it's true, is the greateſt, the nobleſt and moſt difficult Part of Natural Philoſophy.

This Part of Philoſophy has been very variouſly and abſurdly handled by Philoſophers; but in theſe latter Ages, the more ridiculous Fictions with which it formerly abounded, were laid aſide; and the Motions of the heavenly Bodies, by the Invention of proper Inſtruments, came to be better diſcovered; and the general Opinion of Philoſophers has been, that the heavenly Bodies moved by the Force of a Fluid, driving them in their Orbits. And when they purſued this Study a little farther, and begun to en-

quire into the particular Nature of that Fluid, the Manner in which it moved, when impreſſing upon the Stars that Force by which they were kept in their Orbits, and the Cauſe that put it in ſuch a Motion, they went beyond their Depth, and run into many extravagant Opinions, which were inconſiſtent with Nature.

Of thoſe Opinions, the moſt conſiderable was that of *Cartes* and others, who affirmed that the Fluid by which the Planets were forced into Orbits, was made up of a Subſtance of equal Denſity with that Subſtance of which the Planets conſiſted; that the Manner of this Fluid's Motion was in Vortexes; and that the Cauſe by which it was moved in that Manner, was ſome certain Power beſtowed upon the primitive conſtituent Particles of Matter, of turning upon their Axis.

This was the State of Philoſophy, and theſe were the faſhionable Opinions that Men generally entertained

tertained of the Cauſes of the heavenly Motions, when the *Newtonian* Philoſophy made its firſt Appearance; and as the Author of that Philoſophy and others very well obſerve, theſe Opinions were preſt with many and great Difficulties. The Planets did not appear to move in the ſame Manner, as thoſe Vortexes by the Laws of their Motions muſt have forced them to do. It appeared alſo incredible that the Matter which compoſed thoſe Vortexes, was of like Denſity with the Bodies of the Planets. And the turning of the primitive Particles of Matter upon their Axis, and ſuch other Motions as were aſcribed to them, look'd very like a Fiction. Theſe were the Sum of the Difficulties by which this Philoſophy was preſt. And it was for theſe Defects that Mr. *Newton* rejected this Philoſopy, and * as himſelf

* *Hypotheſis vorticum cum Phænominis Aſtronomicis, omnino pugnat & non tam ad explican-*

tells us, he propoſes a new Scheme of his own to clear this Part of Natural Philoſophy of the Difficulties that attended the *Carteſian* Hypotheſis.

Let us then ſee how far our Author's Scheme improves that Part of Natural Philoſophy, and clears it of the Difficulties with which the *Carteſian* Scheme was preſt: Suppoſing our Author's Philoſophy had been ſupported by as good Arguments as it appeared to be.

The Sum of the *Newtonian* Philoſophy, as far as it was ſupported by any Arguments, conſiſted in the Diſcovery of the Quantity or Direction of the Force, by which the Planets were kept in their Orbits, abſtracting from that Being whoſe Force this was; and the other Part

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dos, quam ad perturbandos motus celeſtes conducit; quomodo vero motus iſti in Spatijs liberis abſque vorticibus peraguntur intelligi poteſt ex Libro primo, & in Mundi Syſtemate plenius docebitur, P. 355. *Prin.*

of

of that Philoſophy, which tells us that the Body, to which this Force is directed, impreſſes that Force upon the Planets, is ſuppoſed only, and not the leaſt Shew of Argument offer'd to prove it, as I have ſhewed before. So that no Man could think better of this Philoſophy, than that the Abſtract Quantity of Force, by which the Planets were actuated, was Matter of Demonſtration and Certainty; and that the Aſſertion or Suppoſition, that this Force proceeded from the Action of that Body to which the Force was directed, was Matter of Opinion or Hypotheſis only; no Man could think any better of this Philoſophy, except they took its Author's bare Word for Proof.

It is hardly to be ſuppoſed that Men of Learning or good Senſe could ever have had ſo good an Opinion as this of the *Newtonian* Philoſophy, or have thought that the Quantity or Direction of the Force by which the Planets were actuated,

could be matter of Demonſtration: For they who knew any thing of reſolving Motions, could not but know this in general, that any given Motion whatever may be reſolved into an infinite Number of different Forces; and that therefore it might be Mathematically demonſtrated, that no Demonſtration could ever be brought to prove, of any Motion whatever, that it muſt neceſſarily be produced by any certain Force. And even thoſe who did not underſtand any thing of reſolving Motions, could not but know that the Current of a River (for inſtance) might deſcribe an Arch of ſome Circle; and if a Log of Wood were thrown into this Current, it would force the Wood to deſcribe round the Center of that Circle Areas proportionable to the Times: and yet it is plain, that the Current preſſes not upon that Log of Wood with a Force directed toward the Center of that Circle. And from this Similitude might gather, that a Force directed

rected to a Center, could never be the only Force that could make the Planets describe round that Center Areas proportionable to the Times.

It may indeed be supposed that Men of Learning and good Sense were so far deceived by our Author's Arguments, as to believe that a Centripetal Force might produce the Motions of the Planets, or that these Motions might be accounted for from a Force of that Direction; but it cannot never be thought that any, who considered the Matter, could think that no other Force but that could produce this Effect: Nay, I am convinced that it is true in Fact, that the learned World generally understood no more to be proved by our Author's Arguments, but the fitness of this Force for producing the Effect; and never questioned but a Force of that Direction and Quantity, (whatever this Direction and Quantity was) which a Fluid equidense with the Bodies of the Planets moving in a Vortex of the Shape

Shape of their Orbits could impreſs upon them, was a Force at leaſt as fit for carrying them in their Orbits, as a Centripetal Force could be. So that if the abſtract Quantity of Force had been all the matter in Queſtion, the *Newtonian* Philoſophy could have pretended to be no more than equal with the *Carteſian*.

The *Carteſian* Philoſophy, or the Hypotheſis of Vortexes, (ſays our Author) is preſs'd by many Difficulties: But what Difficulties? Sure it was never by any Man objected againſt this Philoſophy, that the Abſtract Quantity of Force ſuppoſed, was not ſufficient for producing the Motion that appears, *viz.* That the Current of a Fluid equidenſe with the Planets, could not carry them along with it, or impreſs ſuch a Force upon them, as was ſufficient to make them deſcribe ſuch Figures as the Figure of the Vortex. The Difficulties with which this Hypotheſis was preſs'd, only aroſe from what *Cartes* ſaid of the Nature of

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that Fluid which compoſed theſe Vortexes, and the Cauſe and Manner of its being brought and kept in that vortical Motion. If *Cartes* had ſaid no more in Philoſophy, than barely to have condeſcended upon the abſtract Quantity of the Force of his Vortexes, as our Authors do, he would have been clear of all ſuch Objections. And what is it that defends the *Newtonian* Philoſophy from Objections of the ſame nature, but that they advance leſs, and do not tell us what is the Nature of that Being which impreſſes upon the Planets their Centripetal Force; and what is the Cauſe that makes it act upon them, nor in what manner it acts. So that their Philoſophy is only preferable in advancing little: and if this be a Perfection, he that meddles not at all with Philoſophy, is the beſt Philopher.

But after all the Caution the *Newtonian* Philoſophers uſe in this matter, they ſay as much of that which

which, according to them, is the thing that impreſſes upon the Planets their Centripetal Force, as ſhows their Hypotheſis to be in that reſpect preſs'd with much greater Difficulties than any that were ever urged by any Man againſt the *Carteſian* Philoſophy; as ſufficiently appears from the ſlight View I have given of the Abſurdities that may be drawn from their Hypotheſis by phyſical Reaſoning; which all follow from the Nature of that Being, which, according to our Philoſophers, impreſſes upon Bodies their Centripetal Force, and the manner of its performing that Operation; the very ſame Sources from whence thoſe Difficulties, by which the *Carteſian* Philoſophy is preſs'd, does ariſe.

It appears then that the *Newtonian* Scheme did in no reſpect amend the Faults of the *Carteſian* Philoſophy; but in all thoſe very ſame Circumſtances, in which the *Carteſian* Philoſophy failed, was much more de-

defective than it, even if the *Newtonian* Philoſophy had been as good as it can be ſuppoſed to have appeared to any Man of Learning or good Senſe. But let us ſuppoſe the World to have been intirely deluded with the Arguments by which that Philoſophy was ſupported, and to have thought every thing that was in the leaſt like the Shape of a Demonſtration to have been really ſuch, and that thoſe Demonſtrations concluded what the Propoſitions aſſerted in the ſtricteſt Senſe of the Words; ſtill all they could have believed from thoſe Demonſtrations was, that no other Force but a Centripetal could poſſibly produce the Motions of the Planets: But ſtill they had no reaſon to believe it to be certain, that this Centripetal Force was impreſs'd upon the Planets by the Action of that Body which was placed in that Center. For this is what no Propoſition aſſerts, and for which nothing like Proof of any kind is offered. And

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it appears evidently to any Man that will but read over this Philoſophy, that this is only ſuppoſed; and if this be no more than Hypotheſis, why not inquire into the Difficulties by which ſuch an Hypotheſis is preſs'd? Which if any Man had done, could any thing be more obvious than thoſe Difficulties? Such as the Difficulty of ſuppoſing a Body to act immediately in a Place where it did not ſo much as exiſt; or if that was not ſuppoſed to be the immediate Action of that Body, then was it as difficult to find a proper Inſtrument for conveying ſuch an Action.

All the Advantage that could ariſe to the *Newtonian* Philoſophy, from taking for certain all that was ſupported by any thing like Demonſtration, was only that then indeed the Hypotheſis of Vortexes muſt be laid aſide, ſince nothing but a Centripetal Force would do the Buſineſs. But why might not this Centripetal Force ſtill have proceeded from the

Action

Action of a Fluid? The probabilities of a Fluid being the Mover of the Planets, which forced ſo many Philoſophers into that Opinion, ſtill remained in full Force: and it was but changing the Hypotheſis, and inſtead of ſuppoſing the Fluid, by which the Planets were moved, to run round in a Vortex, it might have been ſuppoſed to run to a Center. It's true indeed, the Theorem by which it was demonſtrated, that nothing but a Centripetal Force could cauſe the Planets to deſcribe ſuch Orbits as they do, would in that caſe have been a very conſiderable Improvement to that part of Natural Philoſophy. But ſtill the Author of this Theorem could not be ſuppoſed, by his Invention, to have acquired a right of employing any thing he pleaſed to put in execution that Centripetal Force which he had diſcovered to be neceſſary. So that he ought not in ſuch an arbitrary manner to have affirmed, that his Centripetal Force was produced by

by the Action of that Body to which it was directed. His Diſcovery, at beſt, was but a Diſcovery of the abſtract Quantity of Force, by which the Planets were moved; and not of the Mover, whoſe Force this was. And he ought not to have affirmed any thing to be this Mover, without having ſome other ground for ſo doing, than his having diſcover'd the Quantity of Force impreſs'd upon the Planets. But if he had aſſerted no more than what he ſeem'd to have diſcovered, his Invention would only have appeared to be an Improvement of other Mens Opinions; whereas by managing the Matter as he did, he made much more of his Diſcovery, and paſs'd it upon the World for a whole Scheme of the Syſtem of the Univerſe, perfectly new, and modelled by a Cauſe which he only had found out, and which was utterly unknown to former Ages.

It was a very ſingular Piece of Management in our Author, to make

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ſo much of ſo little, or rather of nothing at all; and to get the World ſo generally to believe an arbitrary Aſſertion, ſupported by no Proof, nay, not ſo much as by the ſhew of any Argument; for no Reaſon, but becauſe he had diſcover'd, or rather ſeemed only to diſcover, ſomething quite different from that Aſſertion; eſpecially, ſince as I have already made appear, this Aſſertion is preſs'd by as great and as obvious Abſurdities and Inconſiſtencies, as it is poſſible for any thing that is aſſerted in Natural Philoſophy to be.

I have hitherto compared this Philoſophy, and its Method, with other Schemes of Phyſicks and their Methods, and particularly, with that which was by the World generally received at the time when this Philoſophy was firſt propos'd, and was generally rejected after its Appearance; and have made appear, that in every reſpect in which that Scheme of Phyſicks was preſs'd with Difficulties, our Scheme was preſs'd with

with much greater ones of the ſame kind: And that tho' our Scheme had been as good as it can be ſuppoſed to have appeared to any Man of Learning or good Senſe, yet it could appear in nothing perferable to that Scheme which was thtown off to make way for it. All which makes the Management by which this Scheme was recommended to the World, appear to be very extraordinary.

I ſhall now enquire into the Reaſonableneſs of a Poſtulate, upon which that Philoſophy depends, *viz.* that the Planets are free of Reſiſtance.

I call this a Poſtulate, tho' both Mr. *Newton* and Dr. *Gregory* pretend to prove it, becauſe the Demonſtration of the former of thoſe Authors depends upon a Poſtulate equivalent to it, *viz.* that the Fluid, which lies betwixt us and the Planets, rarifies in the ſame continued Chain of Proportion that begins in the lower parts of our Atmoſphere; by which

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he computes, as I ſaid before, that the Denſity of that Fluid, at the Diſtance of one of the Earth's Semidiameters from the Surface, is to the Denſity of it upon the Surface, as a Globe whoſe Diameter is equal to the Diameter of *Saturn*'s Orbit is to a Globe of an Inch Diameter; and ſo this Fluid continues to rarify in that Proportion, till it come to the planetary Regions. This Poſtulate, upon which Mr. *Newton*'s Demonſtration of the Abſence of Reſiſtance depends, is certainly equivalent to his poſtulating what he proves; nay, much more ridiculous.

Dr. *Gregory*'s Proof of the Abſence of Reſiſtance, is no more than a Proof that their Scheme cannot ſubſiſt without it: And that Author tells us in plain Terms *, that this Abſence

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* *In Propoſitione ubi determinatur lex vis Centripetæ qua urgetur Corpus quod revolvitur in perimetro Elipſis aut alterius Sectionis Coni, cujus focorum*

ſence of Reſiſtance is all along ſuppoſed in thoſe Propoſitions where their Centripetal Force is reconciled with the Phænomena of the heavenly Motions; nay, the making appear that this is ſuppoſed, and that without that Suppoſition their Cauſe would not be reconciled with its pretended Effects, is all the Demonſtration he brings to prove this Abſence of Reſiſtance.

But that which makes it moſt clearly appear that this is a Poſtulate, is, its being ſuppoſed in Mr. *Newton*'s firſt Propoſition, *L.* 1. and Dr. *Gregory*'s Eleventh Propoſition, *L.* 1. upon which their whole Syſtem depends. For in thoſe Propoſitions it is aſſerted of the moving Body, that if it move a certain Space in a certain Time, it will by the Nature of Bodies in Motion move a Space e-

focorum alter eſt Centrum ad quod vis tendit; ſuppoſuimus motum utrumq; ex quibus Componitur motus in Curva Elliptica Parabolica vel Hyperbolica, omnino liberum nec illi quidquam obſtare aut reſiſtere, &c. L. 1. Prop. 44.

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qual to that Space in equal Time, if nothing hinder it; and upon this theſe Propoſitions depend, as will appear by looking to thoſe Propoſitions themſelves, or to thoſe Propoſitions as I have repeated them in the Beginning of my Remarks. So that all our Scheme is evidently built upon this Poſtulate, that nothing reſiſts the Planets in their Motions. But if any Body were in thoſe Regions through which the Planets move, they muſt force this Body out of their Way, and it muſt return that Force by its Reaction, and this Reaction is Reſiſtance; ſo that if the Planets are not reſiſted, there muſt either be no Body at all in the Planetary Regions, and ſo they are abſolute Voids, or at leaſt ther muſt be no more Body there than Mr. *Newton*'s Computation of the Denſity of the Fluid he allows to be there, will admit; which is much the ſame Thing as no Body at all.

I admire that our Authors ſhould have poſtulated of the World to believe that not to be, which not only all Philoſophers, but (I may rather ſay) all Mankind believed to be. Certainly no Man ever believed the Planetary Regions to be Voids, nor will either Senſe or Reaſon allow any Man to believe it. But ſtill if this Poſtulate had been leſs improbable, and it had been no more than the general Opinion of Mankind, that the Planetary Regions were not void; the Reſpect due to ſuch an univerſal Sentiment in which Men agreed, required ſome Reaſons to be given to the contrary; and it was an extraordinary Piece of Aſſurance, thus to poſtulate of the World, that they would renounce ſo general an Opinion: As much as if it had been ſaid in plain Language, Gentlemen, renounce that Opinion you have always had, and believe the contrary, without any Reaſon for ſo doing.

This is certainly the moſt extravagant Poſtulate that ever was heard of; nay, it is not only ſo with reſpect to the univerſal Belief of the contrary, but alſo with reſpect to the Evidence and Certainty with which the contrary appears, and may be demonſtrated to be true: For what Point in Natural Philoſophy appears with more Evidence, than that the Planetary Regions are not Voids? What Proof does Natural Philoſophy afford that is more ſtrong, or rather what Proof will the Nature of the Subject admit of, that is more evident than the Proof that the Planetary Regions are filled with ſome ſort of Body?

That ſort which moſt certainly appears to fill the Planetary Regions is Light, which I ſhall not here take up Time in proving to be a Body, becauſe that is owned by our Philoſophers; neither ſhall I endeavour to prove any thing particular of the Nature of that Body, or en-

deavour to ſhew it to be ſomething different from what the *Newtonian* Philoſophers believe it to be, tho' I think it ſo, becauſe that relates not to the Point in Hand: For whether it be ſuch a Body as I take it to be, or ſuch as thoſe Philoſophers believe it to be, is all one, as far as concerns the Point in Queſtion. So that I ſhall ſuppoſe it to be juſt ſuch a Fluid as they do, ſent from the Body of the Sun in ſtreight Lines, through all the Planetary Regions ſucceſſively every Inſtant of Time, or by a continu'd Emiſſion of that Fluid from the Body of the Sun.

If then Light be ſuch a Body, is not the Planetary Regions filled with this Body according to our Philoſophers themſelves? And how can they for ſerving a Turn, at another Time aſſert, that the Planetary Regions are Voids? Or at leaſt, what is equivalent to this Aſſertion, that the Planets move thro' theſe Regions free from the Action or Reaction of any thing but Attraction only?

If

If to put aſide this Difficulty, they diminiſh extravagantly the Quantity of Matter contained in the Fluid of Light; as Mr. *Newton* does the Quantity of that other Fluid, which he acknowledges to lie betwixt our Earth and the Planets; and after ſuppoſing the Quantity of this Fluid to be ſuch as will ſuit their Occaſions, then tell us that the Force of the Action of a Fluid being as its Quantity, the Force of the Action of this Fluid is almoſt nothing; it will not be very eaſy to bring full Proof to the contrary. And this Shift is to be expected from our Philoſophers, ſince they have ſuch a ſingular Art in framing Hypotheſes to fit their Purpoſe, and take Liberty to ſuppoſe what they pleaſe, and to turn out of the Syſtem of Nature any thing that is repugnant to their Scheme, though appearing with the fulleſt Evidence imaginable. But if they take that Method in this Caſe, and aſſume ſuch an unreaſonable

Hypotheſis without any Probability, merely becauſe the Inconſiſtence of their Scheme with Nature forces them to do ſo, this will be a Proof of the Falſity of both their Scheme and Hypotheſis; than which it is hard to find better Proof in Natural Philoſophy. For they who indulge themſelves a full Liberty of framing as many Arbitrary Hypotheſes as they have Occaſion for, may ſtand out againſt all the Arguments that can be brought againſt them; for if in any thing they be ſtreighten'd, it's but ſuppoſing ſomething to be ſuch as will ſerve to anſwer the Difficulty, and their Streight is over. And they who can play this Game with a little Art, are Proof againſt all the Demonſtrations that can be brought, and cannot be convicted of their Errors ſo as to be forced to own them to be ſuch.

If our Philoſophers had managed all along this Way, I ſhould have had much harder Work with them than

than I have had; and ſhould never have been able by full and poſitive Demonſtration to diſprove their Philoſophy: For this I have only been able to do, becauſe their Philoſophy conſiſts chiefly in Aſſertions of Abſtract Quantities, which brings it within the reach of Mathematical Demonſtration; whereas this which is a Point of a quite different Nature, is not to be diſproved with equal Evidence.

I ſhall however ſhow, with as great Evidence as the Nature of the Subject will allow, and conſequently as great as is to be expected, that the Quantity of Matter contained in the Fluid of Light is not ſo ſmall, as that the Action of that Fluid upon the Planets ſhould for that reaſon be thought inſenſible; or rather, that in Fact this Fluid acts upon them with a Force that cannot but have ſome ſenſible Effect upon their Motions. For making of this appear,

Let us ſuppoſe the Planets to be covered with Atmoſpheres, or if that be not allowed, let us take for in-

ſtance our Earth, which we know to be ſo. Theſe Atmoſpheres are parts of the Planets, ſince they turn with them upon their Axis, and accompany them in their Motions; in ſhort, thoſe Atmoſpheres are joined to the Planets by the ſame Cement of Gravity (whatever the Cauſe of Gravity be) which keeps together all their other Parts. This appears very clearly to be true in the caſe of our Earth. And if thoſe Atmoſpheres be thus join'd to the Bodies of the Planets, it's plain that any Force impreſs'd upon theſe Atmoſpheres muſt in effect be alſo impreſs'd upon the other Part with which they are connected.

It is very eaſy to judge of the Effect that any Force acting upon our Atmoſphere muſt have upon the Globe, from the Effect it appears to have upon the Atmoſphere, and from the Force that our Atmoſphere can impreſs upon ſolid Bodies; which appears in the Impreſſion that Winds (which are nothing elſe but

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Currents in our Atmoſphere) make upon Bodies; or by computing the Denſity of our Atmoſphere and Globe, and proportioning the Effect of any Force upon theſe two to their Denſities. And ſince the Force of Wind even upon Bodies of great Denſity, appears to be conſiderable, and that the Difference of the Denſity of our Globe and Atmoſphere is not extreamly great; it's plain, that a Force which produces upon our Atmoſphere any great Effect, muſt produce alſo upon our Globe much more than is conſiſtent with that abſolute Freedom in the Motions of the Planets, for which our Philoſophers contend. So that the thing which comes now to be conſider'd is, what Effect the Fluid of Light, the Sun-beams, or whatever elſe That may be called, which the Sun ſcatters continually through the whole planetary Regions, produces upon the Atmoſpheres of the Planets, or upon our Atmoſphere in particular.

This Force is diſcoverable in that

Phænomonon which we call Rarefaction, or Tenſion of Air, which is effected by the Action of the Sun-beams, and cannot be performed without a Force driving the Air from that place which it naturally affects. The Force by which the Sun-beams thus drive the Fluid of our Atmoſphere, may be eſtimated from the Tenſion of Air it produces, and from the Force that is neceſſary to make ſuch Tenſion; which appears from the Inſtruments by which an artificial Tenſion of Air is produced.

The Tenſion of Air that ariſes from the Heat of the Sun, appears very clearly to be produced by a Force, whereby the Sun-beams drive the Air before them in the *Eaſt* Winds, within the Tropicks; and the Effect of this Force, when communicated by our Atmoſphere to the Solid, at leaſt the Watry part of our Globe, which is almoſt Equidenſe with the Solid part, appears alſo very plainly in the conſtant and general Motion of the Sea, in the

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ſame Direction with thoſe Winds. And they who have any Taſte of Natural Philoſophy, will, in this Appearance, evidently ſee that the Sun-beams, with which the planetary Regions are filled, impreſs upon the Planets continually a very conſiderable Force; ſo that thoſe Planets do not, as our Authors ſuppoſe, paſs through theſe Spaces, abſolutely free of any Force acting upon them.

But becauſe every Reader cannot diſcover in this Phænomenon, which I have inſtanced, the Proof of what I aſſert, becauſe they are not accuſtomed to thoſe ways of Thinking that are neceſſary for their perceiving the full Evidence that may be ſeen in that Appearance; I ſhall inſtance another Phænomenon, in which it appears evidently even to the Senſes, that the Sun-beams act with a conſiderable Force upon the Bodies that move through the planetary Regions.

Aſtronomers agree, that all Comets

mets turn their Tails always directly away from the Sun, whether moving to the Sun or from it, or whatever way their Situation in reſpect of it changes; and if ſo, they who have ſeen a Comet, have ſeen it acted upon by the Sun-beams, and they who never ſaw a Comet, have the univerſal Teſtimony of thoſe who have ſeen it.

It is very eaſy to ſhow, that the Force with which the Sun-beams act upon a Comet, is evident in this Appearance, by what our Philoſophers themſelves acknowledge. Sir *Iſaac Newton* ſays *, that the Tails of the Comets are made up of the Exhalations drawn from the Body of the Star by the Heat of the Sun; and that theſe Exhalations near the Body of the Star, appear like Smoke ariſing from it; and when ariſing in great plenty, make the Body of the Star ſeem much more obſcure, and appear with a fainter Light than o-

* *Prop.* 41. *L.* 3. Prin.

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therways it would do. And if this be true, as it certainly is, that the Tail of a Comet is made up of the Smoke and Exhalations, which the Heat of the Sun draws from the Body of the Star, the Matter of which theſe Tails are compoſed before it was by the Heat of the Sun ſeparated from the Body of the Star moved in the ſame Velocity and Direction as the Star, and muſt have continued ſo to do, if moving in a place were nothing acted upon or reſiſted it; and the Smoke and Flame ariſing from the Comets muſt be hindred from keeping cloſe to the Comet, which by the Law of Motion they muſt have done by ſome Force, either by that Force which cauſes the Smoke and Flame proceeding from ſolid Bodies upon our Earth, to tend upwards, or move ſtill directly away from the Earth, *viz.* the greater Gravity of our Atmoſphere; and then this Appearance will prove that Fluid in which the Comets ſwim, to be heavier or more

denſe

denſe than the Exhalations drawn from the Comet by the Heat of the Sun; or elſe thoſe Tails muſt be drove that way by the Force of the Sun-beams.

I believe our Philoſophers will not readily allow, that the Cauſe which forces the Tails of the Comets to point from the Sun, is the ſuperior Denſity of that Fluid in which thoſe Comets ſwim; becauſe this were to allow that Fluid to be of equal Denſity with our Atmoſphere, which it muſt be if that be the Cauſe; ſince we cannot ſuppoſe the Smoke and Exhalations drawn from the Bodies of the Comets, to be of a Nature far different from the Smoke and Exhalations drawn from other Bodies, which does not riſe in a Fluid leſs denſe than our Atmoſphere. This, I ſay, our Philoſophers will not allow, becauſe allowing the planetary Regions to be filled with a Fluid as denſe as our Atmoſphere, were giving up their Cauſe. And if they ſay, that the

Tails

Tails of the Comets are drove by the Sun-beams, they own what I am proving.

For my part, I cannot ſee any other Cauſe from whence the Force by which the Exhalations drawn from the Bodies of the Comets are drove from the Sun can proceed, but thoſe two which I have inſtanced. But it matters not much, whether our Philoſophers allow any of thoſe to be the Cauſe or not, ſince whatever Cauſe be aſſigned for the Production of this Appearance, yet ſtill the Appearance it ſelf ſhows that it is ſomething in the planetary Regions that impreſſes upon Bodies moving through thoſe Regions; ſuch a Force as can upon Smoke produce a very powerful Effect: And this Force, whatever it is that has ſuch an Effect upon the Smoke that ariſes from the Comets, cannot but have ſuch an Effect alſo upon the Atmoſpheres of the Planets, ſince they are made up of a Subſtance very near of the ſame Denſity; nay, whe-

whether the Tails of the Comets be allowed to conſiſt of ſuch Exhalations or not, yet they appear to be parts of the Comets which are joined to them, and move along with them. And without entring into any nice Enquiry into the Nature of thoſe Tails, even they who know nothing of Natural Philoſophy, cannot but ſee from a Comet's turning its Tail always from the Sun, that the Fluid in which it is, impreſſes upon it a ſenſible Force; as well as by ſeeing a Ship that lies at Anchor turn always her Stem to the Tide, or a Weather-Cock ſtill turn his Head to the Wind, they may believe that the Current of Water beats upon the one, and the Wind upon the other. In ſhort, a Man might as well ſee a Ship at Sea, with full Sails, bending from that Side upon which the Wind did beat, and as the Wind ſhifted or the Ship changed its Courſe, ſtill leaning directly away from the Wind, and believe that the Wind impreſs'd upon

on the Sails of that Ship no Force, or that thoſe Sails communicated to the Hull no Force able to produce upon it any ſenſible Effect; as ſee a Comet turning its Tail ſtill away from the Current of Light proceeding from the Sun, and believe the Sun-beams to impreſs upon that Tail no Force, or that the Tail communicated to the Body of the Star no Force that is ſenſible. The Atmoſpheres of the Planets, like the Sails of a Ship, are extended wider through the Regions in which the Planets move, than the Body of the Planet, and ſo are more obnoxious to the Impulſe of that Etherial Fluid, and muſt neceſſarily communicate to the Body of the Planet what Impulſe they receive, either from the Sun-beams, or any other Fluid whatever that is in the planetary Regions. And tho' I might bring very good Arguments for proving other Fluids beſide that of Light to be in theſe Regions; yet what I have proved of that only,

ly is ſufficient; and he who will not by what I have already ſaid be convinc'd that the Stars move not through the Planetary Regions at abſolute Freedom, will never be convinc'd of any thing by Phyſical Reaſoning.

I think it now appears how unreaſonable it was for the *Newtonian* Philoſophers to build their Philoſophy upon an Hypotheſis, that the Planets move through the Planetary Regions at abſolute Freedom: Since that Hypotheſis was not only inconſiſtent with the Opinions of all Philoſophers, but in it ſelf abſurd and inconſiſtent with the Phænomena of Nature. So that not only the Method of the *Newtonian* Philoſophy, and the Philoſophy it ſelf, but the Hypotheſis upon which it is built, is worſe than moſt Hypotheſes upon which other Schemes depend, eſpecially that to which ours ſucceeded.

I have hitherto purſued my Subject, ſo as to ſet it in the beſt

Light

Light I could, without conſidering whether what I happened to ſay might give Offenſe to any Perſon whatever. And upon Reflection, I find that the Proſecution of my Subject, and the Endeavour of ſetting it in the beſt Light, has drawn me to repreſent the famous Sir *Iſaac Newton* as One that has not made ſo great Improvements in Philoſophy as he is generally believ'd to have done; and conſequently, ſome Readers may think, that I derogate from the Honour of that Great Man. For my part, I am quite of another Mind, and believe nothing to be true Honour, but what is built upon a ſolid Foundation, as *Cicero* deſcribes it, *Conſtans Laus bonorum*; and conſequently, that the Honour due to this great Man for his real Improvements of Learning, will remain unſhaken to After-Ages, and is above the Reach of the Tongue or Pen of the Envious; and I ſhould deteſt my ſelf, if I could think that I were capable of the

impotent Endeavour of detracting from his deſerved Praiſe. But if Sir *Iſaac Newton* has in any thing been miſtaken, and the World has been too fond of any of his Miſtakes, and not diſtinguiſh'd thoſe from his ſolid Inventions; it derogates neither from the real Worth of that great Man, nor from his ſolid and laſting Reputation, but rather ſettles it on that Foundation upon which it muſt continue, to undeceive the World in theſe Matters: And beſide this, Truth and the Improvement of Learning, Cauſes of ſo general Concern as not to be over-ballanced by private Conſiderations, require this to be done, and therefore the doing of it needs no Apology.

FINIS.

G. Montague