

A
Confutation of Atheism
FROM THE
Origin and Frame of the WORLD.

PART II.

A
SERMON

Preached at

St. Martin's in the Fields,

NOVEMBER the 7th. 1692.

Being the *Seventh* of the Lecture Founded by
the Honourable ROBERT BOYLE, Esquire.

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Chaplain to the Right Reverend Father in God,

EDWARD, Lord Bishop of Worcester.

L O N D O N,

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ACTS XIV. 15, &c.

That ye should turn from these vanities unto the living God, who made Heaven and Earth and the Sea, and all things that are therein: Who in times past suffer'd all Nations to walk in their own ways. Nevertheless, he left not himself without witness, in that he did Good, and gave us Rain from Heaven, and fruitfull Seasons, filling our hearts with Food and Gladness.

WHEN we first enter'd upon this Topic, the demonstration of God's Existence from the Origin and Frame of the World, we offer'd to prove four Propositions.

1. That this present System of Heaven and Earth cannot possibly have subsisted from all Eternity.

2. That Matter consider'd generally, and abstractly from any particular Form and Concretion, cannot possibly have been eternal: Or, if Matter could be so; yet Motion cannot have coexisted with it eternally, as an inherent property and essential attribute of Matter. These two we have already established

Imprimatur.

*Ra. Barker, R^{mo} in Christo Patri
ac D^{no} D^{no} Johanni Archiep. Can-
tuar. à Sacris Domest.*

LAMBHITH,
Novemb. 10.
1692.

in the preceding Discourse; we shall now shew in the third place,

3. That, though we should allow the Atheists, that Matter and Motion may have been from everlasting; yet if (as they now suppose) there were once no Sun nor Starrs nor Earth nor Planets; but the Particles, that now constitute them, were diffused in the mundane Space in manner of a Chaos without any concretion and coalition; those dispersed Particles could never of themselves by any kind of Natural motion, whether call'd Fortuitous or Mechanical, have conven'd into this present or any other like Frame of Heaven and Earth.

I. And first as to that ordinary Cant of illiterate and puny Atheists, the *fortuitous or casual concurrence of Atoms*, that compendious and easy Dispatch of the most important and difficult affair, the Formation of a World; (besides that in our next undertaking it will be refuted all along) I shall now briefly dispatch it, from what hath been formerly said concerning the true notions of Fortune and Chance. Whereby it is evident, that in the Atheistical Hypothesis of the World's production, Fortuitous and Mechanical must be the self-same thing. Because *Fortune* is no real entity nor physical essence, but a mere relative signification, denoting

Serm. V.
p. 6, 7.

noting only this; That such a thing said to fall out by Fortune, was really effected by material and necessary Causes; but the Person, with regard to whom it is called Fortuitous, was ignorant of those Causes or their tendencies, and did not design nor foresee such an effect. This is the only allowable and genuine notion of the word Fortune. But thus to affirm, that the World was made *fortuitously*, is as much as to say, That before the World was made, there was some Intelligent Agent or Spectator; who designing to do something else, or expecting that something else would be done with the Materials of the World, there were some occult and unknown motions and tendencies in Matter, which mechanically formed the World beside his design or expectation. Now the Atheists, we may presume, will be loth to assert a fortuitous Formation in this proper sense and meaning; whereby they will make Understanding to be older than Heaven and Earth. Or if they should so assert it; yet, unless they will affirm that the Intelligent Agent did dispose and direct the inanimate Matter, (which is what we would bring them to) they must still leave their Atoms to their mechanical Affections; not able to make one step toward the production

Serm. V.
p. 12, 13.

duction of a World beyond the necessary Laws of Motion. It is plain then, that *Fortune*, as to the matter before us, is but a synonymous word with Nature and Necessity. It remains that we examin the adequate meaning of *Chance*; which properly signifies, That all events called Casual, among inanimate Bodies, are mechanically and naturally produced according to the determinate figures and textures and motions of those Bodies; with this negation only, That those inanimate Bodies are not conscious of their own operations, nor contrive and cast about how to bring such events to pass. So that thus to say, that the World was made *casually* by the concurrence of Atoms, is no more than to affirm, that the Atoms composed the World mechanically and fatally; only they were not sensible of it, nor studied and consider'd about so noble an undertaking. For if Atoms formed the World according to the essential properties of Bulk, Figure and Motion, they formed it *mechanically*; and if they formed it mechanically without perception and design, they formed it *casually*. So that this negation of Consciousness being all that the notion of Chance can add to that of Mechanism; We, that do not dispute this matter with the Atheists,

ists, nor believe that Atoms ever acted by Counsel and Thought, may have leave to consider the several names of *Fortune* and *Chance* and *Nature* and *Mechanism*, as one and the same Hypothesis. Wherefore once for all to overthrow all possible Explications which Atheists have or may assign for the formation of the World, we will undertake to evince this following Proposition:

II. That the Atoms or Particles which now constitute Heaven and Earth, being once separate and diffused in the Mundane Space, like the supposed *Chaos*, could never *without a God by their Mechanical affections* have convened into this present Frame of Things or any other like it.

Which that we may perform with the greater clearness and conviction; it will be necessary, in a discourse about the Formation of the World, to give you a brief account of some of the most principal and systematical *Phenomena*, that occur in the World now that it is formed.

(1.) The most considerable *Phenomenon* belonging to Terrestrial Bodies is the general action of *Gravitation*, whereby All known Bodies in the vicinity of the Earth do tend and press toward its Center; not only such as are sensibly

sensibly and evidently Heavy, but even those that are comparatively the Lightest, and even in their proper place, and natural Elements, (as they usually speak) as Air gravitates even in Air and Water in Water. This hath been demonstrated and experimentally proved beyond contradiction, by several ingenious Persons of the present Age, but by none so perspicuously and copiously and accurately, as by the Honourable Founder of this Lecture in his incomparable Treatises of the *Air* and *Hydrostaticks*.

Mr. Boyle's
Physi-
com-Exp.
of Air.
Hydro-
stat. Para-
doxes.

(2.) Now this is the constant Property of *Gravitation*; That the weight of all Bodies around the Earth is ever proportional to the Quantity of their Matter: As for instance, a Pound weight (examin'd Hydrostatically) of all kinds of Bodies, though of the most different forms and textures, doth always contain an equal quantity of solid Mass or corporeal Substance. This is the ancient Doctrine of the *Epicurean* Physiology, then and since very probably indeed, but yet precariously asserted: But it is lately demonstrated and put beyond controversy by that very excellent and divine Theorist Mr. *Isaac Newton*, to whose most admirable sagacity and industry we shall frequently be obliged in this and the following Discourse.

Lucret.
lib. 1.

Newton
Philos.
Natur.
Princ.
Math. lib.
3. prop. 6.

I

I will not entertain this Auditory with an account of the Demonstration; but referring the Curious to the Book it self for full satisfaction, I shall now proceed and build upon it as a Truth solidly established, *That all Bodies weigh according to their Matter*; provided only that the compared Bodies be at equal distances from the Center toward which they weigh. Because the further they are removed from the Center, the lighter they are: decreasing gradually and uniformly in weight, in a duplicate proportion to the Increase of the Distance.

(3.) Now since Gravity is found proportional to the Quantity of Matter, there is a manifest Necessity of admitting a *Vacuum*, another principal Doctrine of the *Atomical* Philosophy. Because if there were every-where an absolute plenitude and density without any empty pores and interstices between the Particles of Bodies, then all Bodies of equal dimensions would contain an equal Quantity of Matter; and consequently, as we have shewed before, would be equally ponderous: so that Gold, Copper, Stone, Wood, &c. would have all the same specifick weight; which Experience assures us they have not: neither would any of them descend in the Air, as we all see they do; because, if all Space was Full, even the Air would be as dense and specifically as

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heavy

heavy as they. If it be said, that, though the difference of specifick Gravity may proceed from variety of Texture, the lighter Bodies being of a more loose and porous composition, and the heavier more dense and compact; yet an æthereal subtil Matter, which is in a perpetual motion, may penetrate and pervade the minutest and inmost Cavities of the closest Bodies, and adapting it self to the figure of every Pore, may adequately fill them; and so prevent all Vacuity, without increasing the weight: To this we answer; That that subtil Matter it self must be of the same Substance and Nature with all other Matter, and therefore It also must weigh proportionally to its Bulk; and as much of it as at any time is comprehended within the Pores of a particular Body must gravitate jointly with that Body: so that if the Presence of this æthereal Matter made an absolute Fullness, all Bodies of equal dimensions would be equally heavy: which being refuted by experience, it necessarily follows, that there is a Vacuity; and that (notwithstanding some little objections full of cavil and sophistry) mere and simple Extension or Space hath a quite different nature and notion from real Body and impenetrable Substance.

(4.) This

(4.) This therefore being established; in the next place it's of great consequence to our present enquiry, if we can make a computation, How great is the whole Summ of the Void spaces in our system, and what proportion it bears to the corporeal substance. By many and accurate Trials it manifestly appears, that Refined Gold, the most ponderous of known Bodies, (though even that must be allowed to be porous too, being dissoluble in *Mercury* and *Aqua Regis* and other Chymical Liquors; and being naturally a thing impossible, that the Figures and Sizes of its constituent Particles should be so justly adapted, as to touch one another in every Point.) I say, Gold is in specifick weight to common Water as 19 to 1; and Water to common Air as 850 to 1: so that Gold is to Air as 16150 to 1. Whence it clearly appears, seeing Matter and Gravity are always commensurate, that (though we should allow the texture of Gold to be intirely close without any vacuity) the ordinary Air in which we live and respire is of so thin a composition, that 16149 parts of its dimensions are mere emptiness and Nothing; and the remaining One only material and real substance. But if Gold it self be admitted, as it must be, for a porous Concrete, the proportion of Void to Body in the texture of common Air will be so much the greater.

Mr. Boyle
of Air and
Porosity
of Bodies.

Mr. Boyle
ibid.

Newton
Philos.
Nat.Prin-
cipia.
Math.
p. 503.

And thus it is in the lowest and densest region of the Air near the surface of the Earth, where the whole Mass of Air is in a state of violent compression, the inferior being press'd and constipated by the weight of all the incumbent. But, since the Air is now certainly known to consist of elastick or springy Particles, that have a continual tendency and endeavour to expand and display themselves; and the dimensions, to which they expand themselves, to be reciprocally as the Compression; it follows, that the higher you ascend in it, where it is less and less compress'd by the superior Air, the more and more it is rarefied. So that at the height of a few miles from the surface of the Earth, it is computed to have some million parts of empty space in its texture for one of solid Matter. And at the height of one Terrestrial Semid. (not above 4000 miles) the *Æther* is of that wonderfull tenuity, that by an exact calculation, if a small Sphere of common Air of one Inch Diameter (already 16149 parts Nothing) should be further expanded to the thinness of that *Æther*, it would more than take up the Vast Orb of *Saturn*, which is many million million times bigger than the whole Globe of the Earth. And yet the higher you ascend above that region, the Rarefaction still gradually increases without stop or limit: so that,

that, in a word, the whole Concave of the Firmament, except the Sun and Planets and their Atmospheres, may be consider'd as a mere Void. Let us allow then, that all the Matter of the System of our Sun may be 50000 times as much as the whole Mass of the Earth; and we appeal to Astronomy, if we are not liberal enough and even prodigal in this concession. And let us suppose further, that the whole Globe of the Earth is intirely solid and compact without any void interstices; notwithstanding what hath been shewed before, as to the texture of Gold it self. Now though we have made such ample allowances; we shall find, notwithstanding, that the void Space of our System is immensely bigger than all its corporeal Mass. For, to proceed upon our supposition, that all the Matter within the Firmament is 50000 times bigger than the solid Globe of the Earth; if we assume the Diameter of the *Orbis Magnus* (wherein the Earth moves about the Sun) to be only 7000 times as big as the Diameter of the Earth (though the latest and most accurate Observations make it thrice 7000) and the Diameter of the Firmament to be only 100000 times as long as the Diameter of the *Orbis Magnus* (though it cannot possibly be less than that, but may be vastly and unspeakably bigger) we must pronounce, after such large concessions
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on that side and such great abatements on ours, That the Summ of Empty Spaces within the Concave of the Firmament is 6860 million million million times bigger than All the Matter contain'd in it.

Now from hence we are enabled to form a right conception and imagination of the supposed Chaos; and then we may proceed to determin the controversy with more certainty and satisfaction; whether a World like the Present could possibly without a Divine Influence be formed in it or no?

(1.) And *first*, because every Fixt Star is supposed by Astronomers to be of the same Nature with our Sun; and each may very possibly have Planets about them, though by reason of their vast distance they be invisible to Us: we will assume this reasonable supposition, That the same proportion of Void Space to Matter, which is found in our Sun's Region within the Sphere of the Fixt Starrs, may competently well hold in the whole Mundane Space. I am aware, that in this computation we must not assign the whole Capacity of that Sphere for the Region of our Sun; but allow half of its Diameter for the *Radii* of the several Regions of the next Fixt Starrs. So that diminishing our former number, as this last consideration requires; we may safely affirm from certain

tain and demonstrated Principles, That the empty Space of our Solar Region (comprehending half of the Diameter of the Firmament) is 8575 hundred thousand million million times more ample than all the corporeal substance in it. And we may fairly suppose, that the same proportion may hold through the whole Extent of the Universe.

(2.) And *secondly* as to the state or condition of Matter before the World was a-making, which is compendiously express'd by the word *Chaos*; they must suppose, that either All the Matter of our System was *evenly* or well-nigh evenly diffused through the Region of the Sun, this would represent a particular Chaos: or All Matter universally so spread through the whole Mundane Space; which would truly exhibit a General Chaos; no part of the Universe being rarer or denser than another. Which is agreeable to the ancient Description of it, That ** the Heavens and Earth had μίαν ἰδέαν, μίαν μορφήν, one form, one texture and constitution: which could not be, unless all the Mundane Matter were uniformly and evenly diffused.*

'Tis indifferent to our Dispute, whether they suppose it to have continued a long time or very little in the state of Diffusion. For if there

* Diod. Sicul. lib. 1. Καὶ τὴν ἕξ ἀρχῆς τῶν ὅλων συντάσσει μίαν ἔχειν ἰδέαν ὁμογενεῖ καὶ ὅλην, μεμυγμένης αὐτῶν τῆς φύσεως, Apoll. Rhodius lib. 1. "Ἦεν δ' ὡς γαῖα καὶ ἑρμανόρη δὲ θαλάσση, τοῖσιν ἅπ' ἀλλήλοισι μὴ συναρθεῖντα μορφήν.

there was but one single Moment in all past Eternity, when Matter was so diffused: we shall plainly and fully prove, that it could never have convened afterwards into the present Frame and Order of Things.

(3.) It is evident from what we have newly proved, that in the Supposition of such a Chaos or such an even diffusion either of the whole Mundane Matter or that of our System (for it matters not which they assume) every single Particle would have a Sphere of Void Space around it 8575 hundred thousand million million times bigger than the dimensions of that Particle. Nay further, though the proportion already appear so immense; yet every single Particle would really be surrounded with a Void sphere Eight times as capacious as that newly mention'd; its Diameter being compounded of the Diameter of the Proper Sphere, and the Semi-diameters of the contiguous Spheres of the neighbouring Particles. From whence it appears, that every Particle (supposing them globular or not very oblong) would be above Nine Million times their own length from any other Particle. And moreover in the whole Surface of this Void sphere there can only Twelve Particles be *evenly* placed (as the Hypothesis requires) that is, at equal Distances from the Central one and each other. So that

if the Matter of our Sytem or of the Universe was equally disperfed, like the supposed Chaos; the result and issue would be, not only that every Atom would be many Million times its own length distant from any other: but if any One should be moved Mechanically (without direction or attraction) to the limit of that distance; 'tis above a hundred million millions Odds to an unit, that it would not strike upon any other Atom, but glide through an empty interval without any contact.

(4.) 'Tis true, that while I calculate these Measures, I suppose all the Particles of Matter to be at absolute rest among themselves, and situated in an exact and mathematical evenness; neither of which is likely to be allowed by our Adversaries, who not admitting the former, but asserting the eternity of Motion, will consequently deny the latter also: because in the very moment that Motion is admitted in the Chaos, such an exact evenness cannot possibly be preserved. But this I do, not to draw any argument against them from the Universal Rest or accurately equal diffusion of Matter; but only that I may better demonstrate the great Rarity and Tenuity of their imaginary Chaos, and reduce it to computation. Which computation will hold with exactness enough, though we allow the Particles

cles of the Chaos to be variously moved, and to differ something in size and figure and situation. For if some Particles should approach nearer each other than in the former Proportion; with respect to some other Particles they would be as much remoter. So that notwithstanding a small diversity of their Positions and Distances, the whole Aggregate of Matter, as long as it retain'd the name and nature of Chaos, would retain well-nigh an uniform tenuity of Texture, and may be consider'd as an homogeneous Fluid. As several Portions of the same sort of Water are reckon'd to be of the same specifick gravity; though it be naturally impossible that every Particle and Pore of it, consider'd Geometrically, should have equal sizes and dimensions.

We have now represented the true scheme and condition of the Chaos; how all the Particles would be disunited; and what vast intervals of empty Space would lye between each. To form a System therefore, 'tis necessary that these squander'd Atoms should convene and unite into great and compact Masses, like the Bodies of the Earth and Planets. Without such a coalition the diffused Chaos must have continued and reign'd to all eternity. But how could Particles so widely dispersed combine into that closeness of Texture? Our Adversaries

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ries can have only these two ways of accounting for it. *Either* by the Common Motion of Matter, proceeding from external Impulse and Conflict (without attraction) by which every Body moves uniformly in a direct line according to the determination of the impelling force. For, they may say, the Atoms of the Chaos being variously moved according to this catholic Law, must needs knock and interfere; by which means some that have convenient figures for mutual coherence might chance to stick together, and others might join to those, and so by degrees such huge Masses might be formed, as afterwards became Suns and Planets: or there might arise some vertiginous Motions or Whirlpools in the Matter of the Chaos; whereby the Atoms might be thrust and crowded to the middle of those Whirlpools, and there constipate one another into great solid Globes, such as now appear in the *World*. Or *secondly* by mutual Gravitation or Attraction. For they may assert, that Matter hath inherently and essentially such an intrinsic energy, whereby it incessantly tends to unite it self to all other Matter: so that several Particles placed in a Void space at any distance whatsoever would without any external impulse spontaneously convene and unite together. And thus the Atoms of the Chaos,

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though never so widely diffused, might by this innate property of Attraction soon assemble themselves into great spherical Masses, and constitute Systems like the present Heaven and Earth. This is all that can be proposed by Atheists, as an efficient cause of a World. For as to the *Epicurean* Theory, of Atoms descending down an infinite space by an inherent principle of Gravitation, which tends not toward other Matter, but toward a *Vacuum* or Nothing; and verging from the Perpendicular * *no body knows why nor when nor where*; 'tis such miserable absurd stuff, so repugnant to it self, and so contrary to the known Phænomena of Nature (yet it contented supine unthinking Atheists for a thousand years together) that we will not now honour it with a special refutation. But what it hath common with the other Explications, we will fully confute together with Them in these three Propositions.

(1.) That by Common Motion (without attraction) the dissever'd Particles of the Chaos could never make the World; could never convene into such great compact Masses, as the Planets now are; nor either acquire or continue such Motions, as the Planets now have.

(2.) That such a mutual Gravitation or spontaneous Attraction can neither be inherent and essential to Matter; nor ever supervene to it,

* Lucret.
Nec regi-
one loci
certa, nec
tempore
certo,

unless impress'd and infused into it by a Divine Power.

(3.) That though we should allow such Attraction to be natural and essential to all Matter; yet the Atoms of a Chaos could never so convene by it, as to form the present System: or if they could form it, it could neither acquire such Motions, nor continue permanent in this state, without the Power and Providence of a Divine Being.

I. And first, that by Common Motion the Matter of Chaos could never convene into such Masses, as the Planets now are. Any man, that considers the spacious void Intervals of the Chaos, how immense they are in proportion to the bulk of the Atoms, will hardly induce himself to believe, that Particles so widely disseminated could ever throng and crowd one another into a close and compact texture. He will rather conclude, that those few that should happen to clash, might rebound after the collision; or if they cohered, yet by the next conflict with other Atoms might be separated again, and so on in an eternal vicissitude of Fast and Loose, without ever consociating into the huge condense Bodies of Planets; some of whose Particles upon this supposition must have travell'd many millions of Leagues through the gloomy regions of Cha-

os, to place themselves where they now are. But then how rarely would there be any clashing at all? how very rarely in comparison to the number of Atoms? The whole multitude of them, generally speaking, might freely move and rove for ever with very little occurring or interfering. Let us conceive two of the nearest Particles according to our former Calculation; or rather let us try the same proportions in another Example, that will come easier to the Imagination. Let us suppose two Ships, fitted with durable Timber and Rigging, but without Pilot or Mariners, to be placed in the vast *Atlantick* or the *Pacifique* Ocean, as far asunder as may be. How many thousand years might expire, before those solitary Vessels should happen to strike one against the other? But let us imagin the Space yet more ample, even the whole face of the Earth to be covered with Sea, and the two Ships to be placed in the opposite Poles: might not they now move long enough without any danger of clashing? And yet I find, that the two nearest Atoms in our evenly diffused Chaos have ten thousand times less proportion to the two Void circular Planes around them, than our two Ships would have to the whole Surface of the Deluge. Let us assume then another Deluge ten thousand times larger than *Noah's*. Is it not now utterly incredible,

credible, that our two Vessels, placed there Antipodes to each other, should ever happen to concur? And yet let me add, that the Ships would move in one and the same Surface; and consequently must needs encounter, when they either advance towards one another in direct lines, or meet in the intersection of cross ones; but the Atoms may not only fly side-ways, but over likewise and under each other: which makes it many million times more improbable, that they should interfere than the Ships, even in the last and unlikeliest instance. But they may say, Though the Odds indeed be unspeakable that the Atoms do not convene in any set number of Trials, yet in an infinite Succession of them may not such a Combination possibly happen? But let them consider, that the improbability of Casual Hits is never diminished by repetition of Trials; they are as unlikely to fall out at the Thousandth as at the First. So that in a matter of mere Chance, when there is so many Millions odds against any assign- Serm. V. P. 32. able Experiment, 'tis in vain to expect it should ever succeed, even in endless Duration.

But though we should concede it to be simply possible, that the Matter of Chaos might convene into great Masses, like Planets: yet it's absolutely impossible, that those Masses should acquire such revolutions about the Sun. Let

us suppose any one of those Masses to be the Present Earth. Now the annual Revolution of the Earth must proceed (in this Hypothesis) *either* from the Summ and Result of the several motions of all the Particles that formed the Earth, *or* from a new Impulse from some external Matter, after it was formed. The *former* is apparently absurd, because the Particles that form'd the round Earth must needs convene from all points and quarters toward the middle, and would generally tend toward its Center; which would make the whole Compound to rest in a Poise: or at least that overplus of Motion, which the Particles of one Hemisphere could have above the other, would be very small and inconsiderable; too feeble and languid to propell so vast and ponderous a Body with that prodigious velocity. And *secondly*, 'tis impossible, that any external Matter should impell that compound Mass, after it was formed. 'Tis manifest, that nothing else could impell it, unless the Æthereal Matter be supposed to be carried about the Sun like a *Vortex* or Whirlpool, as a Vehicle to convey it and the rest of the Planets. But this is refuted from what we have shewn above, that those Spaces of the Æther may be reckon'd a mere Void; the whole Quantity of their Matter scarce amounting to the weight of a Grain. 'Tis refuted also
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from Matter of Fact in the Motion of Comets; which, as often as they are visible to Us, are in the Region of our Planets; and there are observed to move, some in quite contrary courses to Theirs, and some in cross and oblique ones, in Planes inclined to the Plane of the Ecliptick in all kinds of Angles: which firmly evinces, that the Regions of the Æther are empty and free, and neither resist nor assist the Revolutions of Planets. But moreover there could not possibly arise in the Chaos any *Vortices* or Whirlpools at all; either to form the Globes of the Planets, or to revolve them when formed. 'Tis acknowledged by all, that inanimate unactive Matter moves always in a straight Line, nor ever reflects in an Angle, nor bends in a Circle (which is a continual reflexion) unless *either* by some external Impulse, that may divert it from the direct motion, *or* by an intrinsic Principle of Gravity or Attraction, that may make it describe a curve line about the attracting Body. But this latter Cause is not now supposed: and the former could never beget Whirlpools in a Chaos of so great a Laxity and Thinness. For 'tis matter of certain experience and universally allowed, that all Bodies moved circularly have a perpetual endeavour to recede from the Center, and every moment would fly out in right Lines, if they were

Newton
ibidem
p. 480.

not violently restrain'd and kept in by contiguous Matter. But there is no such restraint in a Chaos, no want of empty room there; no possibility of effecting one single Revolution in way of a *Vortex*, which necessarily requires either an absolute Fulness of Matter, or a pretty close Constipation and mutual Contact of its Particles.

And for the same reason 'tis evident, that the Planets could not *continue* their Revolutions about the Sun; though they could possibly acquire them. For to drive and carry the Planets in such Orbs as they now describe, that Æthereal Matter must be compact and dense, as dense as the very Planets themselves: otherwise they would certainly fly out in Spiral Lines to the very circumference of the *Vortex*. But we have often inculcated, that the wide Tracts of the Æther may be reputed as a mere extended Void. So that there is nothing (in this Hypothesis) that can retain and bind the Planets in their Orbs for one single moment; but they would immediately desert them and the neighbourhood of the Sun, and vanish away in Tangents to their several Circles into the Abyss of Mundane Space.

II. Secondly we affirm, that mutual Gravitation or spontaneous Attraction cannot possibly be innate and essential to Matter. By Attraction

traction we do not here understand what is improperly, though vulgarly, called so, in the operations of drawing, sucking, pumping, &c. which is really Pulsion and Trusion; and belongs to that Common Motion, which we have already shewn to be insufficient for the formation of a World. But we now mean (as we have explain'd it before) such a power and quality, whereby all parcels of Matter would mutually attract or mutually tend and press to all others; so that (for instance) two distant Atoms *in vacuo* would spontaneously convene together without the impulse of external Bodies. Now we say, if our Atheists suppose this power to be inherent and essential to Matter; they overthrow their own Hypothesis: there could never be a Chaos at all upon these terms, but the present form of our System must have continued from all Eternity; against their own Supposition, and what we have proved in our Last. Vide Serm. VI. & Serm. VIII. For if they affirm, that there might be a Chaos notwithstanding innate Gravity; then let them assign any Period though never so remote, when the diffused Matter might convene. They must confess, that before that assigned Period Matter had existed eternally, inseparably endued with this principle of Attraction; and yet had never attracted nor convened before, during that infinite duration: which is

so monstrous an absurdity, as even They will blush to be charged with. But some perhaps may imagin, that a former System might be dissolved and reduced to a Chaos, from which the present System might have its Original, as that Former had from another, and so on: new Systems having grown out of old ones in infinite Vicissitudes from all past eternity. But we say, that in the Supposition of innate Gravity no System at all could be dissolved. For how is it possible, that the Matter of solid Masses like Earth and Planets and Starrs should fly up from their Centers against its inherent principle of mutual Attraction, and diffuse it self in a Chaos? This is absurder than the other: That only supposed innate Gravity not to be exerted; This makes it to be defeated, and to act contrary to its own Nature. So that upon all accounts this essential power of Gravitation or Attraction is irreconcilable with the Atheist's own Doctrine of a Chaos. And secondly 'tis repugnant to Common Sense and Reason. 'Tis utterly unconceivable, that inanimate brute Matter (without the mediation of some Immaterial Being) should operate upon and affect other Matter without mutual Contact; that distant Bodies should act upon each other through a *Vacuum* without the intervention of something else by and through which the

the action may be conveyed from one to the other. We will not obscure and perplex with multitude of words, what is so clear and evident by its own light; and must needs be allowed by all, that have any competent use of Thinking, and are initiated into, I do not say the Mysteries, but the plainest Principles of Philosophy. Now mutual Gravitation or Attraction (in our present acception of the Words) is the same thing with This; 'tis an operation or virtue or influence of distant Bodies upon each other through an empty Interval, without any *Effluvia* or Exhalations or other corporeal Medium to convey and transmit it. This Power therefore cannot be innate and essential to Matter. And if it be not essential; it is consequently most manifest (seeing it doth not depend upon Motion or Rest or Figure or Position of Parts, which are all the ways that Matter can diversify it self) that it could never *supervene* to it, unless impress'd and infused into it by an immaterial and divine Power.

We have proved, that a Power of mutual Gravitation, without contact or impulse, can in no-wise be attributed to mere Matter: or if it could; we shall presently shew, that it would be wholly unable to form the World out of *Chaos*. But by the way; what if it be made appear, that there is really such a Power of Gravity

Gravity perpetually acting in the constitution of the present System? This would be a new and invincible Argument for the Being of God: being a direct and positive proof, that an immaterial living Mind doth inform and actuate the dead Matter, and support the Frame of the World. I will lay before you some certain *Phænomena* of Nature; and leave it to your consideration from what Principle they can proceed. 'Tis demonstrated, That the Sun, Moon and all the Planets do reciprocally gravitate one toward another: that the Gravitating power of each of These is exactly proportional to their Matter, and arises from the several Gravitations or Attractions of every individual Particle that compose the whole Mass: that all Matter near the Surface of the Earth, for example, doth not only gravitate downwards, but upwards also and side-ways and toward all imaginable Points; though the Tendency downwards be predominant and alone discernible, because of the Greatness and Nearness of the attracting Body, the Earth: that every Particle of the whole System doth attract and is attracted by all the rest, All operating upon All: that this *Universal Attraction or Gravitation* is an incessant, regular and uniform Action by certain and established Laws according to Quantity of Matter and Longitude of Distance:

Distance: that it cannot be destroyed nor impair'd nor augmented by any thing, neither by Motion nor Rest, nor Situation nor Posture, nor alteration of Form, nor diversity of Medium: that it is not a Magnetical Power, nor the effect of a Vortical Motion; those common attempts toward the Explication of Gravity: These things, I say, are fully demonstrated, as matters of Fact, by that very ingenious Author, whom we cited before. Now how is it possible that these things should be effected by any Material and Mechanical Agent? We have evinced, that mere Matter cannot operate upon Matter without mutual Contact. It remains then, that these *Phænomena* are produced either by the intervention of Air or Æther or other such medium, that communicates the Impulse from one Body to another; or by Effluvia and Spirits that are emitted from the one, and pervene to the other. We can conceive no other way of performing them Mechanically. But what impulse or agitation can be propagated through the Æther from one Particle entombed and wedged in the very Center of the Earth to another in the Center of *Saturn*? Yet even those two Particles do reciprocally affect each other with the same force and vigour, as they would do at the same distance in any other Situation imaginable. And because the

Newton
Philosophiæ
Naturalis
Princip.
Math.
lib. III.

the Impulse from this Particle is not directed to That only ; but to all the rest in the Universe, to all quatters and regions, at once invariably and incessantly : to do this mechanically; the same physical Point of Matter must move all manner of ways equally and constantly in the same instant and moment ; which is flatly impossible. But if this Particle cannot propagate Motion; much less can it send out Effluvia to all points without intermission or variation ; such multitudes of Effluvia as to lay hold on every Atom in the Universe without missing of one. Nay every single Particle of the very Effluvia (seeing they also attract and gravitate) must in this Supposition emit other secondary Effluvia all the World over ; and those others still emit more, and so *in infinitum*. Now if these things be repugnant to human reason ; we have great reason to affirm, That Universal Gravitation, a thing certainly existent in Nature, is above all Mechanism and material Causes, and proceeds from a higher principle, a Divine energy and impression.

III. Thirdly we affirm ; That, though we should allow, that reciprocal Attraction is essential to Matter ; yet the Atoms of a Chaos could never so convene by it, as to form the present System ; or if they could form it, yet it could neither acquire these Revolutions, nor subsist
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in the present condition, without the Conservation and Providence of a Divine Being.

(1.) For first, if the Matter of the Universe, and consequently the Space through which it's diffused, be supposed to be *Finite* (and I think it might be demonstrated to be so ; but that we have already exceeded the just measures of a Sermon) then, since every single Particle hath an innate Gravitation toward all others, proportionated by Matter and Distance : it evidently appears, that the outward Atoms of the Chaos would necessarily tend inwards and descend from all quarters toward the Middle of the whole Space (for in respect to every Atom there would lie through the Middle the greatest quantity of Matter and the most vigorous Attraction) and would there form and constitute one huge spherical Mass ; which would be the only Body in the Universe. It is plain therefore, that upon this Supposition the Matter of the Chaos could never compose such divided and different Masses, as the Starrs and Planets of the present World.

But allowing our Adversaries, that The Planets might be composed: yet however they could not possibly acquire such Revolutions in Circular Orbs, or (which is all one to our present purpose) in Ellipses very little Eccentric. For let them assign any place where the Planets were formed. Was it nearer to the Sun, than the present distances are ? But that is notoriously absurd: for then
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they must have ascended from the place of their Formation, against the essential property of mutual Attraction. Or were each formed in the same Orbs, in which they now move? But then they must have moved from the Point of Rest, in an horizontal Line without any inclination or descent. Now there is no natural Cause, neither Innate Gravity nor Impulse of external Matter, that could beget such a Motion. For Gravity alone must have carried them downwards to the Vicinity of the Sun. And that the ambient Æther is too liquid and empty, to impell them horizontally with that prodigious celerity, we have sufficiently proved before. Or were they made in some higher regions of the Heavens; and from thence descended by their essential Gravity, till they all arrived at their respective Orbs; each with its present degree of Velocity, acquired by the fall? But then why did they not continue their descent, till they were contiguous to the Sun; whither both Mutual Attraction and Impetus carried them? What natural Agent could turn them aside, could impell them so strongly with a transverse Side-blow against that tremendous Weight and Rapidity, when whole Worlds are a falling? But though we should suppose, that by some cross attraction or other they might acquire an obliquity of descent, so as to miss the body of the Sun, and to fall on one side of it: then indeed the force of their Fall would carry them quite beyond

beyond it; and so they might fetch a compass about it, and then return and ascend by the same steps and degrees of Motion and Velocity, with which they descended before. Such an eccentric Motion as this, much after the manner that Comets revolve about the Sun, they might possibly acquire by their innate principle of Gravity: but circular Revolutions in concentric Orbs about the Sun or other central Body could in no-wise be attain'd without the power of the Divine Arm. For the Cause of the Planetary Motions is this. Let us conceive all the Planets to be formed or constituted with their Centers in their several Orbs; and at once to be impress'd on them this Gravitating Energy toward all other Matter, and a transverse Impulse of a just quantity in each, projecting them directly in Tangents to those Orbs. The Compound Motion, which arises from this Gravitation and Projection together, describes the present Revolutions of the Primary Planets about the Sun, and of the Secondary about Those: the Gravity prohibiting, that they cannot recede from the Centers of their Motions; and the transverse Impulse with-holding, that they cannot approach to them. Now although Gravity could be innate (which we have proved that it cannot be) yet certainly this projected, this transverse and violent Motion can only be ascribed to the Right hand of the *most high God, Creator of Heaven and Earth.*

But finally, though we grant, that these Circular Revolutions could be naturally attained; or, if they will, that this very individual World in its present posture and motion was actually formed out of Chaos by Mechanical Causes: yet it requires a Divine Power and Providence to have conserved it so long in the present state and condition. We have shewed, that there is a Transverse Impulse impress'd upon the Planets, which retains them in their several Orbs, that they be not drawn down by their gravitating Powers toward the Sun or other central Bodies. Gravity we understand to be a constant Energy or Faculty (which God hath infused into Matter) perpetually acting by certain Measures and (naturally) inviolable Laws; I say, a *Faculty* and Power: for we cannot conceive that the *Act* of Gravitation of this present Moment can propagate it self or produce that of the next. But 'tis otherwise as to the Transverse Motion; which (by reason of the Inactivity of Matter and its inability to change its present State either of Moving or Resting) would from one single Impulse continue for ever equal and uniform, unless changed by the resistance of occurring Bodies or by a Gravitating Power; so that the Planets, since they move Horizontally (whereby Gravity doth not affect their swiftness) and through the liquid and unresisting Spaces of the Heavens (where either no Bodies at all or inconsiderable ones do occur) may pre-

preserve the same Velocity which the first Impulse impress'd upon them, not only for five or six thousand years, but many Millions of Millions. It appears then, that if there was but One Vast Sun in the Universe, and all the rest were Planets, revolving around him in Concentric Orbs, at convenient Distances: such a System as that would very long endure; could it but naturally have a Principle of Mutual Attraction, and be once actually put into Circular Motions. But the Frame of the present World hath a quite different structure: here's an innumerable multitude of Fixt Starrs or Suns; all of which are demonstrated (and supposed also by our Adversaries) to have Mutual Attraction: or if they have not; even Not to have it is an equal Proof of a Divine Being, that hath so arbitrarily indued Matter with a Power of Gravity not essential to it, and hath confined its action to the Matter of its own Solar System: I say, all the Fixt Starrs have a principle of mutual Gravitation; and yet they are neither revolved about a common Center, nor have any Transverse Impulse nor any thing else to restrain them from approaching toward each other, as their Gravitating Powers incite them. Now what Natural Cause can overcome Nature it self? What is it that holds and keeps them in fixed Stations and Intervals against an incessant and inherent Tendency to desert them? Nothing could hinder, but that the Outward Starrs with
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their Systems of Planets must necessarily have descended toward the middlemost System of the Universe, whither all would be the most strongly attracted from all parts of a Finite Space. It is evident therefore that the present Frame of Sun and Fixt Starrs could not possibly subsist without the Providence of that almighty Deity, *who spake*

Psal. 148. the word and they were made, who commanded and they were created; who hath made them Fast for ever and ever, and hath given them a Law, which shall not be broken.

(2.) And secondly in the Supposition of an *infinite* Chaos, 'tis hard indeed to determin, what would follow in this imaginary Case from an innate Principle of Gravity. But to hasten to a conclusion, we will grant for the present, that the diffused Matter might convene into an infinite Number of great Masses at great distances from one another, like the Starrs and Planets of this visible part of the World. But then it is impossible, that the Planets should naturally attain these circular Revolutions, either by intrinsic Gravitation or the impulse of ambient Bodies. It is plain, here is no difference as to this; whether the World be Infinite or Finite: so that the same Arguments that we have used before, may be equally urged in this Supposition. And though we should concede, that these Revolutions might be acquired, and that all were settled and constituted in the present State and Posture of Things;

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yet, we say, the continuance of this Frame and Order for so long a duration as the known ages of the World must necessarily infer the Existence of God. For though the Universe was Infinite, the Fixt Starrs could not be fixed, but would naturally convene together, and confound System with System: for, all mutually attracting, every one would move whither it was most powerfully drawn. This, they may say, is indubitable in the case of a Finite World, where some Systems must needs be Outmost, and therefore be drawn toward the Middle: but when Infinite Systems succeed one another through an Infinite Space, and none is either inward or outward; may not all the Systems be situated in an accurate Poise; and, because equally attracted on all sides, remain fixed and unmoved? But to this we reply; That unless the very mathematical Center of Gravity of every System be placed and fixed in the very mathematical Center of the Attractive Power of all the rest; they cannot be evenly attracted on all sides, but must preponderate some way or other. Now he that considers, what a mathematical Center is, and that Quantity is infinitely divisible; will never be persuaded, that such an Universal Equilibrium arising from the coincidence of Infinite Centers can naturally be acquired or maintain'd. If they say; that upon the Supposition of Infinite Matter, every System would be infinitely, and therefore equally attracted on all sides; and consequently

frequently would rest in an exact Equilibrium, be the Center of its Gravity in what Position soever: This will overthrow their very Hypothesis; at this rate in an *infinite Chaos* nothing at all could be formed; no Particles could convene by mutual Attraction; for every one there must have Infinite Matter around it, and therefore must rest for ever being evenly balanced between Infinite Attractions. Even the Planets upon this principle must gravitate no more toward the Sun, than any other way: so that they would not revolve in curve Lines, but fly away in direct Tangents, till they struck against other Planets or Starrs in some remote regions of the Infinite Space. An equal Attraction on all sides of all Matter is just equal to no Attraction at all: and by this means all the Motion in the Universe must proceed from external Impulse alone; which we have proved before to be an incompetent Cause for the Formation of a World.

Psal. 8. And now, O thou almighty and eternal Creator, *having consider'd the Heavens the work of thy fingers, the Moon and the Starrs which thou hast ordained*, with all the company of Heaven we laud and magnify thy glorious Name, evermore praising thee and saying; Holy, Holy, Holy, Lord God of Hosts, Heaven and Earth are full of thy Glory: Glory be to thee, O Lord most High.

F I N I S.