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Art. II.—THE NATURAL THEOLOGY OF SIR ISAAC NEWTON.

THE splendour of Sir Isaac Newton's genius is, we suppose, beyond dispute. When every allowance has been made for the decisive researches of Galileo and Kepler, as well as for the trembling guesses of Wren, of Halley, and of Hooke, Newton still stands out as the chosen instrument through whom it pleased Almighty God to publish to the world the chief principles on which the physical machinery of the universe is built. Of the book on "Optics" the main theory, it is true, has been abandoned since the days of Young, and was never without opponents even while Newton lived. Yet the book itself abides—the treasure-house of a noble store of facts of the highest interest to all who make the nature of light and colour the special subject of their study. Possessed, moreover, of a geometrical sagacity superior by far to that of his great predecessor, and in some respects rival, Descartes, Newton was at the same time completely free from the rashness which led the latter to renounce the painful methods of experience and to construct a world from those unproved assumptions which developed later into the pantheism of Spinoza. To a happiness of conjecture which almost seemed to fit him for the anticipation, as Bacon terms it, rather than the interpretation of nature, he joined a laborious patience in experiment which was not unworthy of Kepler. Deeply was he convinced that supposition was of value in science only so far as it ministered to proof, and that no theory could be maintained as true which was not the fruit of an induction as exhaustive as the case permitted. His mind, alike by nature and by training, was hence pre-eminently fitted for the discussion of great subjects with perfect freedom from prejudice and the calmest sobriety of judgment. As long, therefore, as any weight is given to authority as a guide to truth, it is neither possible nor right to overlook what we may term the natural theology of Isaac Newton. Judging merely by the prodigious results which it achieved in physical and mathematical science, the religious conclusions of such an intellect as his would be worth, at least, that passing notice to which we hope to draw our readers in this paper.

1. That, then, which strikes us first in this inquiry is the close relation which seemed to Newton to subsist between theology and science, or at least between the knowledge of the Creator and the study of His works. The error, indeed, of hampering science with theology, or of marring theology by science, he would no doubt have recognised as clearly as Bacon had already done before him. Though he constantly appeals

to that argument from design, which Bacon sometimes wittily depreciates, he would never have allowed its practical application to stand in the way of scientific research, or to hinder a further acquaintance with those facts of the outward world with which physical science is concerned. Yet, on the other hand, he not only assigns, as Bacon does, its special place to theology, but he holds that the fear of God, as an active principle of human life, is bound up closely with the advance of physical knowledge. Thus, in the last of the Queries attached to the treatise on "Optics," he not merely unfolds what seemed to him to be the nature of the relation in which the Creator stands to His works, but the whole book closes with the statement of his opinion that increased knowledge of God's works must bring with it of necessity an increased reverence for their Author's majesty and will. So, in the first of his "Letters to Bentley," who was himself an ardent and sometimes, like Jackson of Leicester, even a fierce defender of some points of the Newtonian theology, he declares that even while he was engaged on his immortal "Principia," he had an eye to such principles as should be of use in proving the existence and attributes of God. Accordingly, in the glorious Scholium, which was added to the second edition of this stupendous work, he rises without effort, and almost by way of necessary consequence, to the statement of the great conclusions he had reached upon this subject. The light, in fact, in which the works of God are presented to us in Scripture, is exactly the light in which they are regarded by Newton.

Newton, however, goes far beyond this. In the course of those parts of his writings to which we have referred,[1] he takes occasion to suggest such lines of thought as seemed to carry with them the convincing evidence, if not of the existence, yet at least of the Supreme Creator's power and wisdom, as well as of the freedom of His will. Yet, though in one passage he even sketches out a view of the way in which he

[1] All the passages in Newton's works, to which in this article reference is made, are to be found in the "Principia" (def. 3, and schol. ad def. 8; lib. i., prop. 64; lib. iii. schol. gen.), in the "Optics" (adv. 2 and queries 18, 19, 21, 22, 28, and 31), in the "Letter to Boyle," and in the "Four Letters to Bentley." Add the striking letter to Dr. T. Burnet given in Brewster's "Life of Newton" (vol. ii., App. No. 6), where he lays down distinctly that the optical is the true principle on which to interpret the record of Creation and other similar passages of Scripture. In Rigaud's "Historical Essay," Playfair's "Dissertation" (Works, vol. ii.), and in Brewster's "Life of Newton" will be found ample information on the historical relations of Newton's discoveries, while on their metaphysical aspects there are many profound remarks in Whewell's "Philosophy of Discovery" and in his "History of Scientific Ideas." Sir J. Herschel ("Discourse," § 301) has paid a splendid tribute to the transcendent intellectual greatness of Newton.

thought that God had formed material substances, he would doubtless have been ready to grant, had he been pressed, that he assumed, here at least, one point which could only be proved by Scripture. As the existence of God is from the first assumed in Scripture, and indeed in some of those uninspired reasonings which profess, apart from Scripture, to demonstrate His attributes and His being, so certainly the fact of the creation of matter is assumed by Newton, and not proved. That which here is really due to Newton is not a proof of its creation, but the revival of that view of its atomic constitution which, while it seems to underlie the Daltonian law of definite proportions in modern chemistry, was substantially the view of many of the ancient Greek philosophers. In their hands too, at first, as in the hands of Newton, it was bound up, as Cudworth argues, with a real theistic belief, though later on, in the hands of Democritus and Epicurus, it became the instrument of the atheism which the genius of Lucretius has so brilliantly adorned. A proof, in truth, of the creation of matter it is beyond the power of human reason to devise. The mind even of Newton, or of Leibnitz, is unequal to the task. One reason is, that the act of creation out of nothing is precisely one of those forms of the Divine working to which we know nothing really similar in our own experience. It is a truth, therefore, for which we are wholly indebted to revelation, and hence it is not only the first which the Word of God reveals, but our knowledge of it is declared expressly to be a knowledge which depends on faith. On the other hand, though the eternity of matter could never be disproved by human reason only, it is but right to add that its existence also is not only, as Berkeley saw, incapable of formal proof, but (as it is vulgarly conceived at any rate) is actually needless, in the view of Boscovich and his followers, to explain the phenomena of the world. It would be wrong, too, to ignore the forceful arguments which were used by the Newtonians of the last century —by Clarke, for instance, and by Baxter—to show, as they term, its merely contingent character. As soon as the Newtonian system had made its way, with its doctrines of the inertia of matter, the order of its dispositions, and the relatively insignificant proportion that all of it together bore to the boundless vastness of what seemed mere empty space, it was easy to see that belief in its contingent and thus created nature was at least more consonant to reason than the belief in its eternal self-subsistence. Yet even here the argument was hard to grasp. It was wholly unfitted to convince the mass of men who, but for the decisive teachings of Scripture, are just as prone as the philosophers to identify the workings of matter and spirit, or at least to confuse them so

inextricably together as to render distinct conception of their respective characters impossible.

2. But however this may be, the discoveries of Newton have recognised as fixed one point with respect to matter which is fraught with consequences of the highest value to natural theology. This is the reality of that property which Kepler termed its *vis inertiæ*, and on which, as on a base, the Newtonian physics are securely built. Apart, therefore, from all metaphysical arguments as to the precise nature of matter in itself, it may be held as certain that wherever matter is, there will be found the property in question. Matter without this *vis inertiæ* would not in fact be matter, either in the popular conceptions of everyday life or in the formal reasonings of men of science. At first sight, the mere statement of this property enforces the conclusion that matter has not within itself the power to change its state of motion or of rest. But this conclusion does not exhaust the subject, or go to the depth of the strangeness of the property in question. The full truth is, that in every particle of matter a force resides which *constantly resists* each effort to move it from its state of rest or motion—resists, moreover, in proportion to the force applied. Insignificant, that is, as the particle is, it is capable of an indefinite resistance notwithstanding. Apart from this, moreover, matter would be of no use for the purposes which it serves at present. The earth would in that case yield under the pressure of the footsteps of a child; the strongest buildings would be ruined by a breath. Strip again from the matter of the earth and planets its resistance to a change of state, and not merely would no force but the slightest be needed to draw them round the sun, but round the sun they could never be drawn at all. Into it by the shortest route they would soon speedily fall. The tangential impulse, if such it really was, by virtue of which the planets were launched upon their orbits, could not for a moment hold out against the attracting influence of the sun. The sun himself, if made of unresisting matter, might be stayed on his course by the resisting finger of a child. Though, therefore, it may be true that motion is in our experience the constant accompaniment, yet it can never with propriety be described as an inseparable attribute of matter. Matter may not merely be conceived to be devoid of motion, without a contradiction in thought, but thus devoid of motion, or at least of self-moving power, in itself and by its very nature it actually seems to be.

Taken by itself, therefore, matter can have no other share in the formation of the world than that which its passivity admits. The atoms of Epicurus, as their patron clearly saw, could of themselves effect nothing. Concourse of atoms there could be none, unless some further principle were introduced not merely

to set these atoms in motion, but to cause them to come into contact with each other. In fact, wherever (save perhaps in one connection) matter is found in motion, there of necessity must be implied upon it the action, direct or indirect, of a something which is not matter, of an immaterial entity—call it for the moment force or spirit. It matters not so far whether we study the stupendous motions of the planets or the hardly discernible changes of a microscopic organism. The argument is still the same. Matter cannot change its state unaided, and in its every change it postulates a force outside itself. In the case, moreover, of such a motion as that of gravitation, the force must needs be ceaselessly and from moment to moment applied. Actually, in any case, as far as our experience goes, this matter-moving entity is everywhere; for, as the modern view of correlation seems to teach, all forces physical may be resolved with more or less distinctness into modes of motion. With the material universe, therefore, this moving principle is coextensive—distinct from, yet embracing the wills of the human and the impulses of the animal creation. But the Christian speculator, with Newton, may go further. This immaterial entity is more than omnipresent. It reveals itself in all its forms as everywhere endowed with the signs of will, intelligence, and power. Even within the limits of the single science of astronomy Newton, as we shall see, has found abundant evidence of this. Nay, of the very atoms which make up the substrate of material things, Herschel and Clark-Maxwell have said that they bear upon themselves the marks of manufacture, that is, of a designing mind.

So far, therefore, as His merely physical attributes are concerned, the Christian conception of God seems to be easily reached—almost, in fact, demonstrably—to all, at least, save those who, to the contradiction of one of the first and most irrepressible principles of their nature, reject the argument from final causes altogether. An immaterial and all-pervading entity, give it what name you will, which is endowed with will and boundless power and wisdom, is at any rate but little distinguishable, His spiritual attributes excepted, from that Divine Creator and Preserver of the world whom the Christian's Scriptures disclose. All who would do justice to this argument should study closely the elaborate reasonings of Andrew Baxter in his Enquiry into the nature of the human soul. No one will then wonder that such a masterpiece of rigid argument should have challenged in our own century the all-but-undeviating discipleship of Robert Hall, and in the last the still more valuable commendation of Warburton.[1]

[1] See Warburton, "Divine Legation," book iii., § 4; book ix., note A; and for Hall's opinion, the Memoir added to his Works (vol. vi.). Baxter

It is true, indeed, that the disciples of Boscovich view what we term matter from a standpoint very different to that which Newton occupied, and seem to reach on physical grounds conclusions almost as far removed from his as those of Bishop Berkeley. In the case, moreover, of Newtonians, their master's conception of matter has in modern times been doubtless altered much. This does not, however, alter greatly the bearing of the argument. Inertia is clearly one of the characters by which the presence of matter is made known to us. What this is in itself, as it is known to God, is after all a question of but slight importance. To us it is an ultimate fact beyond which we cannot go. If, therefore, matter in its essence should prove to be a something wholly different from that which the disciples of either Newton or Boscovich suppose, the fact which is represented by the term inertia would still remain exactly where it was. The terms in which our knowledge is expressed might perhaps require to be altered, but the relation which these terms express would undergo no change. Light is still light whether we explain it by the corpuscular theory of Newton or the undulatory theory of Young. So, whatever be the intrinsic essence of matter, the consequences of its inertia abide the same.[1]

3. At first sight, notwithstanding, the light in which we have regarded matter may seem to be opposed to that great law of gravitation which Newton was himself the first to prove. By virtue of this it is that every particle of matter in the universe attracts every other particle with a force directly proportioned to the mass of the attracting particle and inversely to the square of the distance between them. Hence it is that a stone thrown into the air falls back again to the ground; that the moon is retained in her path around the earth; that the planets roll ceaselessly around the sun; that the sun himself, it may be, revolves around some other sun. By one splendid generaliza-

is certainly one of the most remarkable of the physico-theological writers who in the last century grew up under the shadow of Newton. His "Cosmotheoria," as well as the "Appendix to the Enquiry" in answer to Maclaurin, are well worth study. So also, in spite of the fierceness of his tone, are the last three of Bentley's "Boyle Lectures," which were composed almost under Newton's eye—being, in fact, the occasion, at Bentley's own request, of Newton's famous "Letters." Cheyne, Colliber, and Jackson of Leicester are almost forgotten. But besides his own remarks, Bishop Law has given many extracts from these and other contemporary writers in his Notes to the first chapter of Archbishop King's "Essay on the Origin of Evil."

[1] See Newton, "Principia," def. 3; Boscovich, "Theoria Nat. Phil., p. iii., §§ 382, 516. Cf. Whewell, "History of Scientific Ideas," p. 1, book iii., chap. v.; "The Unseen Universe," §§ 131-136. "Pro materia mihi," says Boscovich, "sunt puncta indivisibilia, in extensa, *prædita vi inertiæ*" (§ 516).

tion it was thus given to Newton to include under a common principle the superbest motions of the planets and the commonest appearances upon the earth. That this law extended throughout the whole of the solar system, and ruled the motions of the comets as well as those of the planets and their satellites, Newton himself was able to show; that it further extends to the motions of the fixed stars also is one of the great results which the astronomers of the present century have wrought out. The rigid proof of this has been indeed as yet presented for only a certain number of the stars, yet no one doubts the literal universality of the law. The negative instances, which could alone cast a doubt upon the point, are not as yet forthcoming, nor is it likely that any such exist. Here, therefore, is found a principle of motion connected so uniformly and so strangely with matter as almost to justify its claim to the title of an inseparable property—if not as essential to our conception of matter, yet universal in our experience of its nature. This was the view of Cotes,[1] the profound mathematician under whose superintendence the second edition of the "Principia" was brought out, and whose early death was so deeply deplored by Newton. Such a position, however, does not seem to be tenable. View gravitation as a principle of attraction on the part of one particle towards another, and there is then no place for this conclusion. The inertia of the particles in question is overcome indeed; but that which is under this term assigned to matter is no longer a self-moving power from within, but a controlling influence from without. View it again as a tendency to motion implanted in the separate particles, and then it is irreconcilable with the inertia which we have already considered.

Clearly the co-existence of a tendency to resist and a tendency to effect a change of state in one and the same subject, is contradictory in reason and practically impossible. If the opposing tendencies are equally balanced, the result would be as though they neither of them existed. If the tendency to change were in excess, that of inertia would be overcome, so that its existence could never be known. If that of inertia were the stronger, as it clearly is, then the tendency to change is to our apprehension as though it existed not. As an inherent tendency to motion, therefore, gravity cannot be an essential attribute of

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Whewell and continental writers have assigned to Cotes the view which is combated in the text. If, however, Mr. Edleston's interpretation is right, Cotes has denied that this was the meaning he intended to convey in the well-known sentences of his Preface to the "Principia." See the curious letter to Dr. Clarke—No. 83 in the "Correspondence between Newton and Cotes," edited by M. Edleston in 1850. For the rest see Brewster's "Life of Newton," vol. i., app. No. 10.

matter. Newton, accordingly, while he accepts the law of gravitation as a fact, guards himself repeatedly against the supposition that he looked on gravity as an essential attribute of matter. So strongly, in fact, was his own judgment set against the view, that in a letter to Boyle, as well as in his "Optics," he hazards what he terms a conjecture on the physical cause of gravity. Vague as the conjecture is, and utterly unable to stand against the remorseless criticisms of Baxter in the last century, or the briefer dissent of Playfair, for instance, in the present, its very nature shows how eager Newton was to seek outside of matter for the cause of that phenomenon whose law he had himself discovered. The conjecture itself, however, of an ethereal medium which pervaded all space and penetrated all bodies was for this purpose of no scientific or philosophic value. It assumed the reality of an ether, of the very existence of which, in the special form which Newton's theory required, we have no proof whatever. In the last century, therefore, this and other objections convinced S'Gravesande, the Dutch exponent of the Newtonian physics, as well as Baxter and Clarke in England, that a mechanical cause of gravity was not to be ascertained by any of the principles which were known to philosophy then. The present century has on this point been as fruitless as its predecessor. So far as appears as yet, there is no reason to give up the conclusion once at least suggested by Newton and so powerfully vindicated by Baxter, that in the force of gravitation we are brought face to face with the immediate hand of God. It is but reasonable, says Sir J. Herschel, to regard the force as the direct or indirect result of a consciousness and a will exerted somewhere, though beyond our power to trace. Efficiently, of course, and in the last result, on any view but that of atheism, God must be the Author at once and the Effectuator of the law. The First Cause, as Newton says, is certainly not mechanical. The only room for question is whether here, as elsewhere, He acts through instruments, or whether we have reached the point where He acts directly and apart from any mediate intervention. To this the only answer is, that in spite of many efforts and assumptions, no mediate instrument adequate to explain the effect has as yet been brought to light and clearly proved.[1]

True, indeed, it is that of the existence of an infinitely light

[1] See, besides the brief statements in "The Unseen Universe" (§ 141), a most instructive article in the *Edinburgh Review* (No. XXV., art. 7), based on the late Professor Vince's pamphlet on "Gravitation." The reviewer, while admitting the physical objections to Newton's conjecture, considers that he has fully shown its merely mathematical possibility. The theories of Descartes and Bernoulli are easily set aside. Against all forms of fluid pressure Boscovich objects the resistance which must

resisting medium in the inter-planetary spaces we have some proof in the increasing diminution of the period of Encke's comet. True it is, also, that the wave-theory of light assumes as its condition the existence of an ether filling all that realm of space that parts us from the farthest of the fixed stars. But this gives us little or no aid. Light is indeed propagated under that same law of the inverse square which governs the force of gravitation; but light is propagated outwardly from its material centres, while gravitation, as we have seen, draws inwards from without the particles on which it acts. Whether, therefore, the luminiferous ether and the inter-planetary medium be one and the same substance or not, it is hard to see how either of them could become even the mechanical instrument of gravitation. But should they be so regarded, it would do no more than remove that difficulty of conceiving how matter could act on matter apart from any intervening means, which weighed on Newton's mind so heavily that he was glad to use the aid of that infinitely subtle ether of which he speaks continually, in spite of his resolute rejection of it to explain the phenomena of light. Real, however, as is Newton's difficulty, the solution involved in a material medium brings no relief to the minds of Boscovich or Playfair or the younger Herschel.

Meantime, it is well worthy of remark, that though we are ignorant of the mechanical cause of gravitation, if such there be, yet the law itself is stamped with the traces of design and the marks of an arbitrary arrangement. No one can well maintain that the law of gravitation, as we find it, is necessary (unless, indeed, the force were of the nature of an emanation) on the ground that any other law involves a contradiction to any of those other physical conceptions which we regard as proved; nor will anyone doubt that other laws of attractive influence might easily in fact have found a place. Gravity, that is, might have been found as now in constant connection with matter, and yet the law by which it acts might have been very different from the present. Thus the force might have acted directly as the distance simply, or inversely as the distance simply, or in a great many other ways—so far, that is, as a mere abstract possibility is concerned. Of some, indeed, of these the possibilities have been actually discussed, and of one

result to the onward motion of the impelled planet or comet ("Theoria," p. iii., § 400). In the theory of Le Sage, which received the countenance of Prevost, and to which the authors of "The Unseen Universe" seem to incline, assumptions are required which are destitute of any proof; and not the least—that to which Boscovich objects—the seemingly prodigious waste of matter. Cf. Herschel's "Astronomy" (chap. viii., §§ 438-440), as well as his important Essay on the Origin of Force (§ 8, "Popular Lectures," No. 12). In the latter passage he pronounces as strongly against the supposition of Le Sage as against that of Newton.

at least Newton himself has shewn the consequences. Upon the whole, however, it results, so far as we know, that while many are wholly inadmissible, none of these laws of central force would subserve completely all the purposes of order and of use which are found under the present arrangement. The mere stability of the system, it is true, would be secured as effectually as it is at present under one or it may be more of the possible alternatives. Other advantages, however, which are nearly as essential as the stability of the system would not be gained under any other law than that which actually rules. Taking, therefore, the fact of the abstract possibility of many other laws of central force with the provable advantages resulting from the present law, and in some respects peculiar to it, we are surely justified in finding, in the form which the law has taken, the evidence of a designing mind as clearly as the force itself infers the constant presence of an immaterial power. Newton himself, we are persuaded, would have argued thus, and would have mentioned this as an evidence of design in his correspondence with Bentley, had he been fully aware of the advantages which the present law of the inverse square possesses over other laws under which an attractive force might have been guided.[1]

4. It is time, however, to leave this, and to come to some further questions on which Newton has left for us the decided expression of his opinion. Assume for a moment not merely that motion is inherent in all matter from its very nature, but that even the special form it takes in gravitation is strictly necessary and therefore inherent also! Even with these concessions the atheist's cause is not greatly the gainer. The existence even then of the solar system as it is, and by consequence of the stellar systems also, would still call for explanation. Matter and motion only may be shown to be unequal on physical grounds to the task of constructing even by the happiest accident the orderly worlds with which we are familiar; or, if in these days we may not say as much as this, at least in Newton's judgment the suggested means are unequal to the effect. Briefly he has touched in the course of his "Letters to

[1] See on this point. and on the evidences of design presented generally by the solar system, Paley's "Natural Theology," chap. xxii.. as well as the whole of the most important second book of Whewell's Bridgewater Treatise on "Astronomy and General Physics." For other possible arrangements for the perpetuity of the solar system with or without the existing law of gravitation, see Sir J. Herschel's "Collected Essays," No. 2. Boscovich is as eager as Newton to demonstrate, on the grounds of his theory, the need of the wisdom, power, and will of God. See "Theoria," App. de Anima et Deo, §§ 550-557. Cf. Herschel, "On the Origin of Force" (§ 12).

Bentley" on some of the possibilities which the atheism of his own and ancient days contemplated, and has recorded his opinion upon each. The problem to be solved is the origin of the solar and other similar systems. The elements which the atheist gives us are space finite or infinite, according to the speculator's choice, matter in clearly limited quantity and motion inherent in it, in the form of gravitation at least. Putting aside the eternity of the system exactly as we now know it, the other alternatives which spring from the possible combinations of these elements may be reduced to three. Matter, in the first place, may be supposed to have been evenly distributed over space whether this be finite or infinite, so that afterwards, by the power of gravity, it became condensed into the solar and planetary globes. But the very supposition of this original state contradicts in Newton's view one of the elements upon which it is based. If gravity be inherent in it, matter never could have been thus evenly disposed without the exertion of the Divine arm to keep in equipoise the assumed tendency to motion of all its particles; and, if such equipoise were once adjusted, the resulting state must stay unchanged for ever until the Divine arm again dissolved it by the liberation of the inherent element of motion. An uneven distribution, therefore, is all that remains, and this in a space finite or infinite. If the space be finite, all the particles of matter would be drawn at length together to form one single mass—a state, that is, to which the solar system has not as yet and cannot ever come. If, then, the space be infinite, the formation of systems of suns, planets, and comets, which might in some respects be like our own, seems to be a barely possible, however improbable, result. Even then, however, certain peculiarities of our system remain which cannot be explained on the principles assumed or on the assumption of any merely mechanical causes. Intelligence and power and will combined, in other words God, is the indispensable requirement to the rational explanation of the facts.

This leads us straight to the consideration of that system with which we are and for ever must be far more closely acquainted than with any others that fill the boundless realms of space. At any rate, in its present form its literal eternity is impossible. With regard to the earth, geology decidedly teaches this. Though it may not be able to point out exactly what was the earth's primeval state, yet it can show distinctly, and with some real approach to chronological order, that successive changes of vast importance have already taken place upon its surface, that others are even now in progress, and that, as ages roll on, yet others will probably follow. These flow, moreover, in the main, from the regular action of constant forces

which are bound up with the very structure of the earth and that relation to the sun in which it has for ages stood. This, therefore, disproves at once that the present order on the earth either has been in the past, or will be in the future, eternal. So again, if the question be argued on merely physical grounds, there are reasons which similarly disprove the literal eternity in the past or in the future of the other elements of the solar system in their present shape. In fact, the desire in ancient times to construct the universe out of the principles of matter and motion only, and the desire at present to accept in some form or other the nebular theory of La Place, proceed equally on the assumption that there has been a time when the facts of the physical world were different from what they now are.

When we go further and inquire whence these changes came, Newton points to several facts which seem to him to prove the presence of thought and power and will acting on elements in themselves unable to effect the results in question. (1) As things are, the sun, which is not merely the mightiest power of the system but its all-but-single source of light and heat, is found in that central position which enables him to act to the greatest advantage for the benefit of all the bodies which revolve around him. Even if it be true that Jupiter and Saturn are in themselves to some extent, as well as by reflection, light-givers to their attendant moons, the force of this argument is not much changed. The same appearance of design, which is suggested by the position and office of the sun combined, is suggested with almost equal force in connection with those secondary systems of which these planets are respectively the rulers. (2) In three respects, at least, the orbits of the planets and their satellites deserve remark. They are all nearly circular, are found in nearly the same plane, and with the exception of the satellites of Uranus, their direction is from west to east. For this there is no necessity in the nature of things, and accordingly the numerous comets of our system move in orbits highly elliptical with every possible inclination to the ecliptic, and with motions, as the case may be, from east to west or west to east. From gravity alone, whatever might be the case with the motions of the comets, this orderly arrangement of the planets could not spring. (3) The largest planets are not merely placed on the outskirts of the system, but have orbits which deviate from the perfect circle less by far than those of the smaller planets Mercury and Mars. As a rule, that is, where the orbits are most eccentric, there the masses of the planets are the smallest. (4) To this, moreover, should be added the diurnal revolution of the earth upon its axis with the similar revolutions of the sun and planets, as well as that adjustment

of the special velocity, mass and distance of each separate planet, apart from which the present orbits of the planets could never have been traced.

Strange, however, as under any circumstances these arrangements must appear, they have grown in intellectual interest from the time that La Grange and La Place announced the splendid discoveries which they had achieved. To Newton himself, the permanency of the solar system was not only not proved, but, as he may have thought, it lay beyond the reach of proof. At least, as ages passed, he contemplated the necessity of God's interposing hand to correct the effect of those internal elements of change which, if unchecked, would bring in time the present system to a close. It appears, however, that no such interposition is needed. The stability of the system and the permanent though periodic regularity of its motions have been demonstrated by La Place to be secured, and as it seems so far for ever, by some of those very peculiarities of arrangement which attracted the eye of Newton. Within the system itself, the provision is found which puts a limit to the power of those elements of change, whose otherwise unrestricted progress would have wrought eventual ruin on the present form of things. Had Newton known this, he would have been struck yet more by the manifest signs of contrivance and design which the planetary system thus exhibits. La Place, who had neither the religious faith nor the mental comprehensiveness of Newton, was yet himself so struck by the results of his inquiry that he searched for some physical cause which might explain the mystery. The theory of probabilities convinced him that of all improbabilities the greatest was that these appearances should be the effect of chance. Hence therefore, and to avoid the religious conclusion of Newton, he conceived that nebular hypothesis which in one form or another has since his time exercised so great a fascination on the minds of men of science. So far, however, as the cause of religion is concerned, it leaves the matter nearly as it was. Granting, what some may still doubt, that the hypothesis explains the facts, yet the conjecture, for as such only La Place proposed it, cannot then dispense with the conception and the workings of Almighty God. In the construction and development of this primordial nebula, with the central sun whose atmosphere it was, the Divine skill and power are needed just as fully as upon Newton's simpler view. The primitive vapour must be capable of coherence, of contraction, of separation, as well as of a constitution generally such that in the issue and under the appointed laws it would yield these fruits of order, use and beauty with which our minds and eyes have grown familiar. The power, therefore,

and the skill of God are not proscribed as needless, but only shifted in their place and mode of working.[1]

After all that we have now said, it is hardly needful to dwell upon the fact that Newton by conviction as well as by education was a devout believer in a personal God. To him the Supreme Creator and Preserver of things was far more than a mere mechanical or dynamical postulate, necessary argumentatively to explain in reason the origin and continued subsistence of the world. He was a living Entity to Whose power, wisdom, goodness and will no limits could be set by either the nature of things or the reason that was devoted calmly to their study. Nothing can be finer than that expression, not of his faith only, but of his rational conviction, with which the immortal "Principia" is wound up. However ignorant of the ways and teachings of science, all serious searchers after truth should read the splendid sentences in which the great geometer opens out his own conception of the infinity, eternity and substantial omnipresence of God. Add to these his "Letters to Bentley," and the striking Queries in the book on "Optics" which treat of the same subjects; and whether he assents or not no man of sense and reason and (we may add) of modesty, will doubt that he has something put before him which is worth his study. As a matter of fact some of our greatest masters in the last century of philosophical theology drew their forms of reasoning and fundamental arguments from the teaching of these pages. That these writers are so little studied reflects no credit on the mental patriotism, while it detracts from the argumentative vigour, of the present generation.

5. Two points, however, still remain in connection with our subject on which we feel that something should be said, how-

[1] In one form or another, the so-called nebular hypothesis is constantly assumed by modern scientific writers as though it were proved. It is right, therefore, to observe that such is not the case. Rigid proof is of course impossible; but as yet it can hardly be said that it has upon its side more than a possibility—a probability, at any rate, determined as yet rather by scientific preferences than by cogent evidence. Accordingly no less an authority than Sir J. Herschel, in his address to the British Association in 1845, has decisively denied to the hypothesis any other than a merely speculative character ("Collected Essays," No. 14). Brewster similarly has pronounced against it as "incompatible with the established laws of the material universe" ("Life of Newton," vol. ii., chap. xvii.). See also the powerful objections marshalled aggainst it by Professor Sedgwick ("Discourse," 5th ed., App., Note D, and Supp. No. 1)—objections recently reiterated by Mr. Proctor in defence of his own theory of meteoric aggregation ("Other Worlds than Ours," chap. ix.). But no explanation of the means employed can overthrow the evidences of design exhibited in the result. Cf. Janet, "Final Causes," book i., chaps. i., v., vii.

ever brief. The first of these relates to the mighty question of the Unity or Oneliness of God. In defence of this Newton suggests an argument which, though it has its value, is far from strictly proving the attribute in question. In the same sentence in which he assumes the similarity of the general structure of the solar and the stellar systems, he fastens upon the wonderful phenomenon of light as still further leading to the conclusion that the Creator of these worlds and of the light by which their presence is declared to us, can be but One. The similarity of solar to stellar light was up to a point known to him from his own researches, and had he lived to witness the discoveries of Fraunhofer and the later developments of spectroscopy, his argument so far would have been greatly enlarged. Even if light does not imply that bond of physical continuity between our own and other worlds, which the Duke of Argyll seems to suggest, it is at least an evidence of the general identity of those physical principles which pervade, as far as we can trace them, the farthest limits of the visible universe. The proved universality, so far as we can gather, of the law of gravitation, as well as a multitude of facts connected with our own earth, illustrate the same view certainly with an ever-accumulating force. Greatly, however, as the sphere of the argument has been enlarged since Newton's days, and indefinite as may be the future sphere of its enlargement, it is still to be noted that under no circumstances can it rise to the height of a complete proof of the absolute Unity of God. A unity of counsel as respects our earth and the world of which it forms a part is all that can thus be strictly proved, as Paley and Brown put it in the meagre chapters they have given to the subject. But this unity of counsel is quite consistent not only with that view of the Divine Trinity which the early Fathers took, as Pearson and Bull interpret them, but equally so with that later scholastic view which in its tendency to give not merely distinction but mutual independency to the Divine Three, goes far to break up that view of the Unity which is suggested by the language of Scripture. Nay, further, this unity of counsel is quite consistent in reason with the existence of any number of Divine beings, provided that for the time they act in concert and with a joint combination of purpose and resources.

But if within the known limits of the universe it be thus impossible to prove the existence of one Divine Being only, proof of any sort is clearly hopeless in regard to those parts of the universe which are placed beyond the utmost boundaries of our knowledge. Finite, as in a sense the universe is, that is, as bounded at least by the wisdom and power of the glorious Being Who created it, yet to us it is so practically infinite

that we can set no bounds in thought to its extent. Hence, therefore, we can have no proof that there may not exist, in darkness to us impenetrable, other worlds besides our own, ruled by other Divine Beings, in power, will, and wisdom equal to Him Whom we on this earth adore. The plain truth is that to Scripture, and to Scripture only, we must look for the proof of the absolute unity of the Divine Being and the refutation of all polytheistic claims. As Waterland tacitly admits in his minute dissection of his opponent's famous argument, Clarke and his champion Jackson are not wrong when they deny to human reason the power to prove by any of the ancient methods the unity and in their full extent the physical attributes of God. On the other hand, few would now rest the proof on that metaphysical reasoning which Clarke and his admirers consider as not only reasonable but triumphant; though it must be confessed that both the famous Nonconformist Howe, and, among our own divines, the not less famous Dr. Thomas Jackson, while they use a different form of words, seem still in substance to reason in much the same way. Even Bishop Butler, however reluctantly, assents to the postulate of Clarke, that whatever be the internal necessity for the Divine existence, it must act equally, not only at all times but in all places, and thus become exclusive of the claims of any other unknown rival to the place and attributes of Deity. So helpless, therefore, is the unaided human reason on what at first sight seems to be an obvious truth. The very Scriptures, which prove to us decisively the doctrine of the Trinity, are also the only sure authority for that side of the truth which forms the basis of the Unitarian creed.[1]

The second point which still remains for notice is the view which Newton took of space and time. To each of these he assigns a substantial reality, not merely as the fruit of the power, but as inseparable from the existence of God. While he allows to the full the relative aspects in which they may both be viewed, he yet maintains that these relations do not exhaust the full conception which the terms imply, and that to each an absolute existence must be assigned, dependent not upon the will but on the being of God. God, by the very

[1] See Waterland, "Dissertation," chap. ii.; Clarke's "Demonstration," "Correspondence with Bishop Butler," and "Answers to a Sixth and a Seventh Letter;" Jackson of Leicester's "Defence," chap. v. Cf. Howe, "Living Temple," part i., chap. iv.; Dr. T. Jackson, "On the Creed," book vi., part i. Howe, as Mr. Rogers has observed, has anticipated Clarke in much of his reasoning, as well as Paley in his illustration of the watch. Clarke, as well as Paley, may, however, have been ignorant of Howe's writings, though Jackson, Clarke's disciple, quotes from the "Living Temple" more than once.

modes of His existence, constitutes, as he phrases it, both the one and the other. The real removal or annihilation of space seems to him impossible. This would be to remove itself from itself, as he expresses it in a well-known sentence of his "Principia." Against, therefore, the common view, he does not hesitate to identify space and duration with the so-called immensity and eternity of God. He thus suggests an easy argument, not merely for the virtual, but also for the substantial or essential omnipresence of God. Though he is most careful to refuse to God the merely abstract titles of immensity and eternity, though he rejects as wholly inadequate the view that would make God the vital spirit merely of the world, and though he earnestly warns against assigning more than a relative value to those human phrases and conceptions under which the Divine nature must to us be imaged, yet he does not hesitate to affirm that space, in some sense, stands to God in the same relation as the brain stands to His intelligent creatures. As we in our brains perceive the images of things sensible, so in some similar sense in space God perceives the things themselves. Hence, therefore, of course results further the universal knowledge or omniscience of God.

Whether Newton himself intended by these statements more than an illustration of the Scriptural truths of God's physical attributes, may reasonably enough be doubted. His disciple Clarke,[1] however, was not content with this, but claimed, on the strength of the Newtonian conceptions, to raise a proof even of the very existence of God. Space, he reasoned, and duration are substantial things. They remain, and to our apprehension they must remain, even after the universe has been cleared of every form of created being. Self-subsistent, however, they cannot be. It results, therefore, that they are properties, and demand as the cause of their existence a Being in time and place commensurate with themselves; in other words, the infinite and eternal God. So tempting is the view thus opened out, that even Bishop Butler in the end appears in part to have endorsed it. Yet still the argument cannot be thought conclusive. Even if we grant the absolute nature of space and of duration, and recognise so far the superiority of Clarke's reasonings to those of Leibnitz, and Jackson's of Leicester to those of Law, yet still the assumed conclusion will not follow. Though the abstractions of immensity and eternity cannot of course be self-subsistent, yet it could not be proved that their concretes, space and dura-

[1] See Clarke's "Demonstration," and "Correspondence with Leibnitz and Butler;" Jackson's "Defence;" and compare Saisset's beautiful Essay on Newton's Theology in his "Religious Philosophy" (vol. i., Eng. Trans.).

tion, might not perhaps be so. At any rate, if it should seem to any that Clarke's reasonings here may fairly challenge something of the value which he claims for them, and are free from that tendency to Spinozism which Clarke would have abhorred as fully as his critic Saisset, it is a clear misuse of words to connect the title *à priori* with this portion of his famous "Demonstration." Really the reasoning proceeds from effects to causes in that *à posteriori* method which was not only that which we have seen Newton himself delighted to use, but which alone has been admitted by divines in general as of strict validity in inquiries into the existence and attributes of God.

ARTHUR CHARLES GARBETT.

ART. III.—SAINTS' DAYS IN THE CHURCH'S YEAR.

V. MAY. ST. PHILIP AND ST. JAMES.

A. THE JOY OF TEMPTATION.

"*Blessed is the man that endureth temptation.*"—JAMES i. 12.

WHEN our eye falls upon the description given in our Prayer Book of the commemorative character of the first of May, a question immediately arises as to the combination of the two names which meet us there. We ask why St. Philip and St. James are associated so closely together, and why in this association they are separated off from all the other Apostles. Now we might without difficulty enter at once upon a very profitable train of thought, without caring to answer such questions. We might call to mind that the Lord, during His earthly ministry, sent forth His disciples "two and two;" that this arrangement contains a very useful instruction for us in regard to many parts of our Christian work, and that the principle involved in it reappears very suggestively in earlier and later parts of the Gospel history.[1] We might even be content, taking the title of this festival as our starting-point, to dwell on the mere fact of *association* in Christian work as involving an admonition to us of perpetual value; and to this side of the subject we may revert when we reach another case of duplicate commemoration in the month of October.

In the present case—in the instance of May-day—there is something more to be said on this side of the subject, which is worthy of a moment's attention. This first day of May was in ancient times a festival commemorative of all the Apostles;

[1] See Mark vi. 7, comparing xiv. 13 and i. 16-19.