Boscovich's Force Curve, Leibniz's Monad, and How God Created and Sustains the Universe

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Abstract. Boscovich developed the cyclical curve of the universal force between clumps of atomic matter as a function of distance of separation R. From the Principles of Simplicity and Continuity he reasoned that there could only be one force between "atoms" and it varied cyclically with distance of separation R. From the Principle of Continuity he reasoned that matter cannot be subdivided indefinitely, because this would produce $1/R^2$ infinities in the force of gravity as two atoms got closer to one another. Thus reason dictates that at some scale matter can no longer be subdivided into smaller particles. The Monad, the smallest unit of matter, must be of finite size and continuous. The Monads must be of great strength to resist further subdivision. Arthur Compton's last graduate student, Winston Bostick, discovered that the only candidate for this monad or "atom" of matter is the extremely strong toroidal charge ring or soliton (standing wave of the electromagnetic field). This also implied that the electrodynamic force should be Boscovich's universal force. All of these findings fully support the Biblical view of how God created and sustains everything in the universe. It also points out that matter and charge are not the source of the fields in the universe, but that the standing waves in the electromagnetic field of God are the source of all matter.

Introduction. Every once in a while a science researcher stumbles across some information that scientists have forgotten about. This article describes one such discovery. When the author was doing historical research for his book **The Universal Force Volume 3 – An Electrodynamic Model for the Atom and the Nucleus**, he found that European scientific societies recognized Roger Boscovich as the leading authority on atomic theory as well as the originator of the unified field theory hundreds of years before Einstein tried to develop it.

Who was Boscovich? Roger Joseph Boscovich (1711-1787) was a physicist, astronomer, mathematician, philosopher, diplomat, poet, theologian, Jesuit priest, and polymath from the city of Dubrovnik in the Republic of Ragusa (modern day Croatia). Note that Nikola Tesla (1856-1943) was also from Croatia.

Boscovich studied and lived most of his life in Italy and France where he also published many of his works. [1] Despite the limitations imposed upon his thought by religious obedience to the Jesuit priesthood, he is recognized as a natural philosopher of world stature, one of the last of the polymaths. In the country of Croatia Boscovich's picture appears on the front of the 1, 5, 10, 25,

100, 500, 1000, 2000, 5000, 10000, 50000, and 100000 Dinara bills. A sample is shown in Figure 1. In Yugoslavia his picture appears on stamps. See Figure 2.

Figure 1 Picture of Boscovich on Croatia 500 Dinara Bill

Figure 2 Picture of Boscovich on a Yugoslavia Stamp

A brief history of Boscovich reveals the extraordinary nature of this man. His father died when he was very young, but by the age of 8 or 9 he acquired the rudiments of reading and writing from the priest Nicola Nicchei of the Church of St. Nicholas. On September 16, 1725 Boscovich left his home in Dubrovnik for Rome in the care of two Jesuit priests. They took him to the Society of Jesus which was famous for its education of youth and having at that time over 800 schools and 200,000 pupils under its care throughout the world. He graduated and entered the priesthood as a Jesuit priest in 1731 and spent his first two years in Sant'Andrea delle Fratte. There he studied mathematics and physics and was so brilliant in his studies that he made a name for himself with an elegant solution of the problem of finding the Sun's equator and determining the period of its rotation by observation of the spots on its surface. Shortly thereafter in 1740 he was appointed professor of mathematics at the college.

Despite the arduous duties of his professorship, he found time for investigation in various fields of physical science and published many dissertations on such subjects as the transit of Mercury, the Aurora Borealis, the figure of the Earth, the observation of the fixed stars, the inequalities in

terrestrial gravitation, the application of mathematics to the theory of the telescope, the limits of certainty in astronomical observations, the solid of greatest attraction, the cycloid, the logistic curve, the theory of comets, the tides, the law of continuity, the double refraction micrometer, and various problems in spherical trigonometry.

His reputation was growing so quickly that in 1742 he was consulted, along with other men of science, by Pope Benedict XIV, to find the best means of securing the stability of the dome of St. Peter's in Rome in which a crack had been discovered. Boscovich's suggestion of placing five concentric iron bands around the dome was the one adopted.

In 1745 Boscovich published **De Viribus Vivis** (The Vital Force) [2] in which he tried to find a middle way between Isaac Newton's gravitational theory and Gottfried Leibniz's metaphysical theory of monads. According to Leibniz monads are the true "atoms" of nature. Monads are composed of a simple substance with no mass, but they combine into composite structures that do have the property of mass. In contrast to the Cartesian idea of matter, Leibniz claimed that monads were the only genuine substance. The type of matter discussed by Descartes, of which matter extension is an integral part, is not an integral part. Boscovich developed a concept of "impenetrability" as a property of hard bodies which explained their behavior in terms of force. Once impenetrability was disassociated from matter hardness based on extension, then it could be given a relationship to elasticity. This notion of impenetrability had a Cartesian sense that more than one point cannot occupy the same location at once.

In 1750 Boscovich agreed to take part in the Portuguese expedition for the survey of Brazil and the measurement of a degree of arc of the meridian for map making. However, he was persuaded by the Pope to stay in Italy and measure an arc of two degrees between Rome and Rimini. The operation was completed in two years and the results were published in 1755. The work allowed the publication of a more accurate map of the States of the Church. The publication of the map included an appendix outlining an objective procedure for determining suitable values for the parameters of the fitted model from a greater number of observations. This fitting procedure is now known as the L1-norm or Least Absolute Deviations procedure and serves as a robust alternative to the familiar L2-norm or Least Squares fitting procedure.

In 1758 Boscovich published in Vienna the first edition of his famous work, **Theoria philosophiae naturalis redacta ad unicam legem virium in natura existentium** (Theory of Natural Philosophy Derived to the Single Law of Forces Which Exist in Nature**)**. [3] This book contained his atomic theory and his theory of forces. A second edition was published in 1763 in Venice and a third edition in Vienna in 1764. In 1922 it was published in English in London, and in 1966 in English in Chicago.

In 1760 an occasion to exercise his diplomatic ability arose. The British government suspected that warships had been outfitted in the port of Dubrovnik for the service of France and that the neutrality of the Republic of Ragusa had been violated. Boscovich was selected to undertake an

ambassadorship to London to vindicate the character of his native city and satisfy the government. This mission he discharged successfully – a credit to his diplomatic skills and a delight to his countrymen. During his stay in England, he was elected a fellow of the Royal Society.

The Boscovich Force Curve. In his book **Theory of Natural Philosophy Derived to the Single Law of Forces Which Exist in Nature** [3], Boscovich presented his famous cyclical force curve between particles of matter as shown in Figure 3 below.

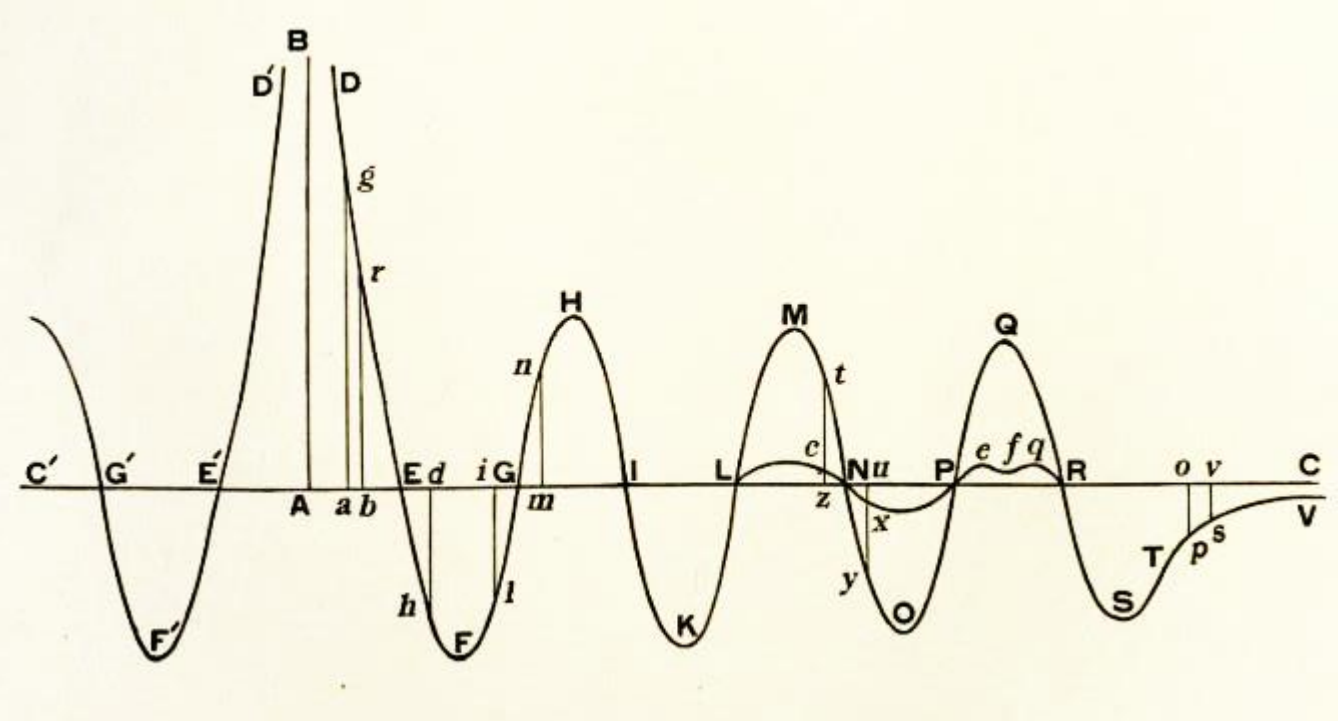

Figure 3 Boscovich Cyclical Force Curve between Particles of Matter [3]

The vertical parameter is the force and the horizontal parameter is the distance between the particles of matter. When the curve is below the axis the force is attractive and when it is above the axis the force is repulsive. For Boscovich this force curve represents the empirical forces between collections of atoms in the form of bodies or particles. At a large distance R the curve represents the attractive $1/R^2$ gravitational force. As bodies are brought closer together in astronomy, they reach certain distances of separation which are in equilibrium where there are no net forces. This is similar to the orbit of the sun going around the center of the Milky Way Galaxy, the Earth moon system going around the sun, and the moon going around the Earth. At even smaller distances we see a rock sitting at rest on the surface of the Earth. One could go even further and talk about the forces between chemical atoms in a crystal or molecule or the forces between quarks in elementary particles like protons and neutrons within the atom.

Principle of Continuity. According to the Principle of Continuity Boscovich's force curve must be continuous. All processes in nature up to that time had been observed to be continuous.

One can break rocks into smaller rocks and the centers of these smaller rock pieces can get closer together, but they cannot occupy the same space. Two liquids can intermix, but if they do not chemically react with one another the net volume is just the sum of the two separate volumes indicating that no two atoms occupy the same space. However if the liquid atoms react chemically to make larger molecules, the net volume of the reactants will decrease. This indicates that the original atoms or molecules have gotten larger by combining to form a larger molecule. The new combined molecule is larger and occupies more space than the original molecules. However, since there are now fewer molecules the space between the molecules has been reduced. This continues to support the idea that no two atoms can occupy the same point in space.

As the two particles get very close to the origin and one another on Boscovich's force curve, the $1/R^2$ forces such as gravity or the electrostatic force get very, very large approaching infinity in magnitude. The Principle of Continuity does not allow the forces between the particles to become infinite. They must have some finite limiting value to correspond to what is observed. This suggests that "atoms" must have a finite size and are sufficiently strong to not break apart under the normal forces in nature.

Principle of Simplicity. The Principle of Simplicity suggests that in order to have simple continuity, there should be only one force. Newton called this force a universal force. The universal force must be both attractive and repulsive in different circumstances at different distances. Thus the force of gravity, which is only attractive, cannot be a candidate for the universal force. It must be a special case of the universal force that is always attractive due to special circumstances.

The key to explaining Boscovich's cyclical force curve is to discover the special circumstances or arrangements of Leibniz's monads that could produce attractive only forces at very large distances and different attractive and repulsive forces at smaller distances. Thus the properties of Leibniz's monad structures would hold the key to the discovery of Boscovich's universal force.

The Monad. The word monad comes from the Greek monas (μονάς) or "unit" and from monos (μόνος) which means "single" or "unique". [4] Epicurus (341 - 270 BC) described monads as the smallest units of matter, much like Democritus's (460 – 370 BC) notion of an atom. Many other Greeks including Pythagoras, Parmenides, Xenophanes, Plato, Aristotle, and Plotinus used monad as a term or symbol for God the first being or the totality of all beings. The Monad was the source or expression of the one being without division. In cosmogony monism is the metaphysical and theological view that all is of one essence. The monad is the expression of that essence. According to Diogenes Laertius (3rd century BC) [5] these monads combined to form dyads, triads, quatrads, etc. culminating in the four elements of earth, water, fire, and air.

Leibniz's Monad. Leibniz (1646–1716) pursued the problem of describing the real and indivisible unit of substance. He was unhappy with both the Cartesian and the atomist theory of matter. The ancient Greek atomists believed that matter could be cut into smaller and smaller pieces and that there was a void between the pieces. If that were true then Newton's (1643 – 1727) $1/R^2$ force of gravity would become infinite between atoms. Descartes (1596 – 1650) believed that the basic laws of motion depended on the somewhat illusionary concept of hard extension which was incompatible with atomism. Atomism was more arithmetical in nature and Cartesianism was more geometrical in nature. Leibniz realized that force was a better concept to describe motion and interactions between the basic units of matter. It avoided the problem of defining hard extension and the geometry of the monad.

The essence of Leibniz's approach is that a quantitative conception of the relation of whole and parts affords an inadequate theory of substance. The common element in the contrary positions of the Cartesians and the Atomists is the explicit or implicit reduction of qualitative to quantitative differences. To Leibniz the solution of the dilemma is to be found in the hypothesis that the essence of substance is non-quantitative such that the relation of whole and parts must be conceived as intensive rather than extensive. Thus a simple substance has no parts or quantitative elements, but it must have a simple unity. It must consist of something. It must have some properties.

Leibniz reasoned that extension enters into the essence or nature of matter, but it does not constitute its whole essence. Similarly magnitude enters into the essence of extension, but is not equivalent to it. Number, time, and motion have magnitude, but they are not extension. Extension is nothing but an abstraction and requires something which is extended. It presupposes some quality, some attribute, or some nature in the thing which extends or diffuses itself along with the thing continuing itself.

A mathematical point may be regarded as indivisible, but only because there is nothing in it to divide. A point cannot have unity, for there is nothing to determine its unity. Descartes's mathematical points are indivisible, but they are only mathematical modalities or abstractions having no real physical existence. The continuous monad, though it can be described in terms of indivisible points, is not composed of them. [6]

Leibniz's monad is an attempt to describe a unit of substance which avoids the imperfections of both Cartesian and Atomist theory. This unit must be real and indivisible. It must have a finite size and a continuous structure so strong that it cannot be easily broken. The monads may be aggregated together to form larger structures with new properties. These aggregates may be broken apart into smaller aggregates or its basic monads.

Leibniz believed that "the smallest part of matter must have a certain spontaneity or power of acting from within itself." He describes the individual substance as essentially a "force" rather than a quantity. The smallest part of matter must have a "perception" of its environment and

"appetition" or potential to realize itself. In the past Greeks imagined atoms as having specific geometrical shapes. Leibniz's atoms or monads are characterized by continuous forces which have no "hard" boundaries which normally define shape. The monads are flexible to some extent.

Monads are the basic substances that make up the universe but lack spatial extension and hence are immaterial. [7] Each monad is a unique, indestructible, dynamic, soul-like entity whose properties are a function of its perceptions and appetites. All are perfectly synchronized with each other by God in a pre-established harmony. The objects of the material world are simply organized collections or structures of monads.

Leibniz's monads have perception (or awareness of environmental forces) but not in the sense of consciousness. For consciousness is not the essence of perception, but merely an additional determination belonging to certain kinds or degrees of perception. Conscious perception is called by Leibniz "Apperception". Monads alone are real. Every change in nature must be reflected by change within monads. The monad is perceptive in a dynamic and not a static way. A human can be perceptive without choosing to react (passive or static perception). Each monad is a part or element of the universe in the sense that each represents it or reflects it as in a mirror from some particular angle or perspective. In some sense the whole universe must be the infinite totality of all monads representing the universe from every possible point of view.

While monads are entirely separate from one another, each must represent the universe at its location which is different from all other locations. No two monads or aggregates of monads can occupy the same point in space and be exactly the same. This is a consequence of the Principle of Continuity.

In the system of monads the Principle of Continuity replaces the "void" in the older atomism. Leibniz substitutes for an extensive plenum of mass an intensive continuum of force. The conception of continuity escapes the contradictions that are involved in the idea of a void. Everything in the world acts and reacts upon everything else. The influence may in some cases be imperceptible or infinitely small, but it exists.

Leibniz operates under the hypothesis that God is the sole real cause of all monads. They have no power or existence of their own.

Summary of Boscovich's Atomic Model. From an analysis of his atomic force curve and the Principles of Continuity and Simplicity Boscovich determined by logic that on the smallest scale the universe is made of monads or atoms which are finite-size continuous particles of great strength that do not break apart under normal circumstances and have no inherent property of mass. This model is most appropriate for the ancient model of the atom originated by Mochus the Hebrew lawgiver as recorded by the Indian Jains [8] which has been identified with the quarks and leptons which are the building blocks of elementary particles. The chemical model of the atom would be developed later and built from the electron, proton, and neutron elementary

particles which in turn are composed of quarks and leptons. Is there any experimental evidence to support Boscovich's atomic model that avoids the $1/R^2$ infinity problem at very small distances and supports the notion of a single continuous universal force?

Experimental Evidence to Support Boscovich's and Leibniz's Atomic Model. The evidence to support Boscovich's atomic model based on monads all came after his death. It started with the discovery of solitons or the monad of matter. Solitons are long lasting semi-permanent standing wave structures with a stable algebraic topology. [9] The soliton can exist in air or water as a toroidal ring. Solitons in water are usually formed in pairs known as a soliton and anti-soliton. Their structure is weak and they decay away after 10 or 20 minutes.

Bostick's Plasmons. Winston Bostick (1916-1991), the last graduate student of Nobel Prize winner Arthur Compton (1892-1962), experimentally discovered how to make "plasmons" or solitons from the electromagnetic field within electromagnetic plasma. [10] These structures were very strong compared to solitons in air and water. They had very long lifetimes and could not be destroyed by normal processes in nature. Bostick proposed that electrons were just simple solitons and positrons were contrary or anti-solitons. All other elementary particles were built of more complex geometrical structures such as dyads (pairs of monads), triads (three monads), quatrads (four monads), etc. All plasmons or solitons in the electromagnetic field are of the same shape, i.e. a toroidal ring. The plasmon was of very great strength. Bostick tried to create a bottle from plasmons to hold controlled thermo-nuclear fusion. All materials known to man up to that time slowly disintegrated when exposed to controlled thermo-nuclear fusion. Only the plasmon was strong enough, but Bostick failed to succeed in building a bottle from plasmons.

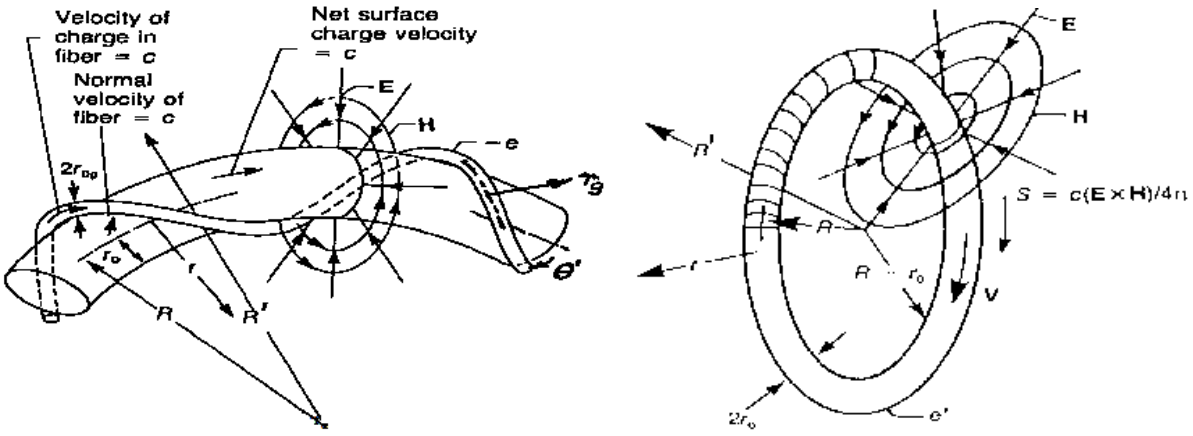

Figure 4 Bostick's Plasmon in the Shape of a Toroidal Ring [10]

Hooper's Electromagnetic Field Experiments. The nature of the plasmon, electromagnetic soliton, or monad was more completely revealed by another modern day scientist, William J. Hooper [11]. He discovered that charged elementary particles, such as the electron, were not only made out of the electromagnetic field, but variations in the field around them due to

their structure extends to great distances. This same feature is also observed about solitons in water.

Hooper [11] also discovered that there are three types of electric and magnetic fields. One of these types is due to velocity effects from Lenz's Law causing it to have the property that it cannot be shielded. Thus portions of the electromagnetic field exist everywhere in the universe.

Conclusions. Experimental evidence has been found for the existence of the Monad of the Indian Jains, Epicurus and the Greek philosophers, Leibniz, and Boscovich. The Monad is a soliton or standing wave of the electromagnetic field which is of great strength. Its field extends to great distances. All elementary particles, atoms, nuclei, molecules, etc. are built from Monads. The electromagnetic force is the universal force of Boscovich. [12]

The Bible says in Colossians 1:16-17 that God is the creator and sustainer of all things in the universe. The Bible also claims in Habakkuk 3:4 that God exerts his power and control of the universe via electromagnetic fields and lightning emanating from him. [13] If God is the source of all electromagnetic fields in nature, then this explains how he could create standing wave monads from a great distance and form from them all the atoms and matter in the universe. By means of the electromagnetic field emanating from him, God could also sustain all the monads comprising all the matter in the universe.

Thus there appears to be some agreement between the Indian Jains, Epicurus and the ancient Greek philosophers, Leibniz and Boscovich that the universal force is electromagnetic and all matter is composed of monads or toroidal ring standing waves of the electromagnetic fields emanating from God. This is the subject of the author's new book to be published this winter. [14]

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