

Erudite Musings from the pen of Stanley L. Jaki

The contributions which Stanley L. Jaki, winner of the Templeton Prize for 1987, has made in his many publications has unveiled a deeper understanding of the relationship between the Christian faith in God the Creator and modern science.

Father Jaki, a Benedictine priest, was born on 17 August 1924 in Hungary and holds double doctorates, one in nuclear physics and the other in theology. He was the Distinguished Professor in the history and philosophy of science at Seton Hall University.

The goal of this document is to illustrate some of his stunning observations, interpretations, and analyses concerning the connection between the history of science and Christianity.

He passed away in Madrid, Spain, on 7 April 2009 after suffering a heart attack.



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Rise and Philosophy of Modern Science

Science found its only viable birth within a cultural matrix permeated by a firm conviction about the mind's ability to find in the realm of things and persons a pointer to their Creator. All great creative advances of science have been made in terms of an epistemology germane to that conviction, and whenever that epistemology was resisted with vigorous consistency, the pursuit of science invariably appears to have been deprived of its solid foundation.

The Road of Science and the Ways to God, p. vii

The rise of science needed the broad and persistent sharing by the whole population, that is, an entire culture, of a very specific body of doctrines relating the universe to a universal and absolute intelligibility embodied in the tenet about a personal God, the Creator of all.

The Road of Science and the Ways to God, p. 33

... the history of science with its several stillbirths and only one viable birth, clearly shows that the only cosmology, or view of the cosmos as a whole, that was capable of generating science was a view of which the principal disseminator was the Gospel itself.

The Origin of Science and the Science of Its Origin, p. 99

All great cultures that witnessed a stillbirth of science within their ambience have one major feature in common. They all were dominated by a pantheistic concept of the universe going through eternal cycles. By contrast, the only viable birth of science took place in a culture for which the world was a created, contingent entity.

Science and Creation, p. 357

As to the directives, the chief end of them derives from that pattern which shows science finding in all ancient cultures a blind alley for its promising starts. A principal element of that pattern is the hold which the distinctly theological tenet of eternal cycles had on ancient cultures. It is well known that a very different theological tenet, which implied the linear process from an absolute beginning, or the creation of all, to an absolute end, was the broadly shared view when science at long last found its road to unlimited advance.

The Road of Science and the Ways to God, p. 18

The birth of science came only when the seeds of science were planted in a soil which Christian faith in God made receptive to natural theology and to the epistemology implied in it. The transition from that first viable birth to maturity was made neither in the name of Baconian empiricism nor in the name of Cartesian rationalism. The transition was made in a perspective adopted by Newton, chiefly

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responsible for completing that transition. The next two centuries saw the rise of philosophical movements, all hostile to natural theology. Whatever lip service to science, they all posed a threat to it. The blows they aimed at man's knowledge of God were as many blows a knowledge, at science, and at the rationality of the universe. All those philosophical movements from Hume to Mach also meant an explicit endorsement of the idea of eternal returns, an idea which from the viewpoint of science acted as the chief road into its great historical blind alleys.

The Road of Science and the Ways to God, p. 160

Science ... cannot arise, let alone gain sustained momentum, without an articulate longing for truth which in turn presupposes a confident approach to reality.

Science and Creation, p. 19

The present and past of scientific history tell the very same lesson. It is the indispensability of a firm faith in the only lasting source of rationality and confidence, the Maker of heaven and earth, of all things visible and invisible.

Science and Creation, p. 357

To cultivate a science which has grown, in virtue of a viable birth, into a robust being, an explicit faith in Creation is not necessary. But since any such being lives in terms of the logic of its conception and birth, scientific blind alleys immersed in philosophical darkness will be in store for those who chart, intentionally or not, avenues whose sense is diametrically opposed to the most creative innovation in human thought, the Christian doctrine of creation of all out of nothing in the Beginning.

Science and Creation, pp. 366-367

This identity (e.g., notion of inertia) must steer a middle course between nominalism (The doctrine holding that abstract concepts, general terms, or universals have no objective reference but exist only as names), in which no two valid notions can overlap every so slightly, and idealism (The theory that the object of external perception, in itself or as perceived, consists of ideas), in which the overlapping of all is well-nigh complete. Neither of these two extremes is germane to science. Indeed, the most successful cultivators of science were drive toward that epistemological middle road, another pattern which gives a striking measure of identify to the whole scientific enterprise ...

The Road of Science and the Ways to God, p. 242

The deeds if not always the words of scientists show that they have always held a fairly steady set of propositions as verities, of which two are of fundamental importance for the scientific enterprise. One is the existence of a world intrinsically ordered in all its parts and consistent in all its interactions. The other is the existence of a human mind capable of understanding such a world in an ever more comprehensive manner. This belief must have its basis (if experiments are to make sense) in a universe existing independently of their own ideas.

The Road of Science and the Ways to God, pp. 247-248

The errors of absolutizing empiricism or idealism—The former assumes a complete identity between nature and mind. The latter is based on assuming a complete independence of the mind with respect to nature. As long a one or the other is absolutized, the relation of the mind with nature will seem paradoxical.

The Road of Science and the Ways to God, p. 252

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Nature is complex, but not chaotic. Regularities are obvious, but so are departures. These departures (or anomalies) spark curiosity in the mind, a feature which is mysterious only to those who are busy with the task of clearing up the process of understanding without admitting their curiosity about the task it.

The Road of Science and the Ways to God, p. 252

Wonderment is the heart of scientific understanding and no wonderment is meaningful if that understanding did not carry one to an objectively existing physical reality.

The Road of Science and the Ways to God, p. 258

If a physicist does not wish to consider the possibility that the mind is capable of understanding reality because both mind and reality are the products of the ... [Creator], then the very same physicist must rest satisfied with what Gilson called "the paradoxical experience of the unintelligibility of intelligibility."

The Road of Science and the Ways to God, p. 259

By reaching back to the empirical the mind retains its sense of reality threatened by logicism, keeps its sanity endangered by idealism, and readies itself for a new soaring above the flatlands of empiricism. Such is the gist of the meaning of the long road of science for natural theology, which is so largely a concern about the ways to God.

The Road of Science and the Ways to God, p. 260

Science is inseparable from that process of comprehending which is a conscious experience tying the real world and the knower into a unity.

The Road of Science and the Ways to God, p. 261

Science is now in possession of such a vast interconnection of data, laws, and instruments as to continue its progress even if no attention is paid any longer to that faith which played an indispensable role in its rise.

Cosmos and Creator, p. 139

The world is a chain of things about which modern science has unfolded an astonishing measure of specificity, consistency, and unity.

Cosmos and Creator, p. 102

... the single-minded attention which in scientific work is given to quantitative correlations cannot help weakening sensitivity for the realm of qualities and values.

Chance or Reality and Other Essays, p. vii

The scientist assumes the reality of things before he can engage in his only legitimate business which is to establish the quantitative properties of things existing.

Universe and Creed, p. 66

The whole history of physics is in fact a series of misguided philosophies grated on most valuable quantitative data.

Universe and Creed, p. 76

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... investing science with a prophetic and messianic role has not been the doing of science. Exact science, or rather its best cultivators, have never claimed that role. Exact physical science came into its own when during the seventeenth century it eliminated from its ken questions about existence, meaning, purpose, and the like. No wonder that sensitive physicists instinctively reject appeals from shortsighted humanists to do science in a so-called meaningful, or prophetic way. The cultivation of that meaningfulness is the business of the philosophy of being, or metaphysics, and of religion, if one wants to go even further. This is not to suggest that science is not full of philosophical presuppositions. But philosophy as such is not a direct part of the scientific strategy of exploring what can be known quantitatively about nature and existence.

Chance or Reality and Other Essays, p. 138

The rise of science to a unique level of creativity during the century of genius [17th century–JN] is an indisputable fact and so is the sound of jubilation which accompanied the advance of those geniuses from nature to nature's God.

Chance or Reality and Other Essays, p. 164

To foresee the behavior of things, man had to depersonalize his study of the universe. It was as if one were to consider the beautiful display on the state of nature a poetic disguise and look for the ultimate reality in the ugly, soulless mesh of ropes, pulleys, and levers found backstage.

The Relevance of Physics, p. 51

For all its greatness, the scientific mind is not infallible. In its reasonings it repeatedly became the victim of foibles, biases, prejudices, and even of sheer blindness to the obvious.

The Absolute Beneath the Relative and Other Essays, p. 65

Biblical Theology

The starting point of theology is the doctrine of creation, namely, that all material beings display something of the rationality and coherence of the Creator.

Numbers Decide and Other Essays, p. 62

... in the Creeds ... the existence of the universe has ... been proposed as an objective reality whose existence can only be known through revelation.

Universe and Creed, p. 69

Nothing is indeed so true and so important as to emphasize that the Christian faith is a trinitarian faith.

Universe and Creed, p. 72

The emphatic assertion that the entire material universe, that greatest object of science, is rational not only in its heavenly parts but in its totality, has its origin in that chief of all Christian dogmas which is about the divinity of Christ.

Universe and Creed, p. 73

A classic target of sophomoric rationalism and vicious bias which often parade in the cloak of science, the first chapter of Genesis is, in fact, a most lucid expression of that faith in the rationality of

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the universe without which the scientific quest in man could not turn itself into a self-sustaining enterprise.

Science and Creation, p. 146

The fall had cosmic relevance but not in the sense of destroying the investigability of a rationally ordered contingent nature.

The Road of Science and the Ways to God, p. 135

Obviously, man could not be a mirror image, that is, a univocal replica of God. Nor could the phrase “image of God” be a sheer play upon words, a meaningless equivocation. Between the two extremes was the realm of analogy.

The Road of Science and the Ways to God, p. 54

Metaphysics is founded in the doctrine of creation—It was this belief, as cultivated especially within a Christian matrix, which supported the view for which the world was an objective and orderly entity investigable by the mind because the mind too was an orderly and objective product of the same rational, that is, perfectly consistent Creator.

The Road of Science and the Ways to God, p. 242

If one does not wish to hear the highest answer to metaphysics, one should not delight in raising the deepest question.

The Road of Science and the Ways to God, p. 259

[Scientists must accept objective coherence in a *universe* of God’s making, not a *multiverse* of man’s construction, if there is to be any such thing as real science]. If not, “any analysis of knowledge becomes a celebration of incoherence.”

Cosmos and Creator, p. 97

[The universe] has supreme coherence from the very small to the very large.... It is beautifully proportioned into layers of dimensions and yet all of them are in perfect interaction.

Cosmos and Creator, p. 42

For reasons inherent in the method of physical science, no watertight proof of the existence of God can be built on its data and conclusions. But this also meant that no refutation of the existence of God could be built on physics either.

The Absolute Beneath the Relative and Other Essays, p. 71

Chinese science

... behind the unfathomable forces of the Yin and Yang there was nothing to look for, certainly not a Lawgiver, or a Governor of all.

Science and Creation, p. 31

The China of the fifteenth century had millions of men to spare in addition to having ships, but she had no navigators with enough will and curiosity to sail to Australia, let alone to the Californian coastlands.

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The Road of Science and the Ways to God, p. 17

Greek science

His [Heraclitus] thinking is indeed a classic example of the sad unbalance which is ultimately imposed on one's thinking by the acceptance of the endless, cyclic recurrence as the basic pattern of existence. Within that framework one was ultimately left with no consistency in reasoning and observation ... Clearly, in a philosophy of nature steeped in the idea of perennial cycles there remained ultimately no room except for disconnected sense perceptions.

Science and Creation, p. 107

In the universe of Anaxagoras ... there was no room ... for considering what the gods represented, namely, will, purpose, and personal determination. In short, in the book in which Anaxagoras ascribed everything to the mind there were regularities, but no mind which regulated, planned, and did so for a purpose.

Science and Creation, p. 108

The Stoic emphasis on the continuum and its application to certain geometrical problems provided the ground on which ancient Greek mathematicians made halting steps toward infinitesimal calculus.

The Road of Science and the Ways to God, p. 29

... their [Greek] failure in science will keep haunting historians wary of theology.

The Road of Science and the Ways to God, p. 33

Tannery ... pointed to the domination of Hellenistic thought by Stoic philosophy, which, because of its fundamentally utilitarian character, was hostile to science.

The Road of Science and the Ways to God, p. 33

[Because of their view of the cosmos and history which had no beginning and no end, Greek philosophers] were ... trapped in the treadmill of endless repetitions.

The Origin of Science and the Science of Its Origin, p. 93

As Hellenism was succeeded by the Hellenistic age, the creative energies of many a genius were locked in producing further variations of well-known and well-worn themes, an enterprise that could only run aground in the boredom of a dead end.

The Road of Science and the Ways to God, p. 25

The physics and cosmology that could be had on such a basis was as elusive as [Platonic] shadows are.

The Road of Science and the Ways to God, p. 21

Plato subjects man's comprehension of God to the pessimistic logic of eternal recurrence in which each cosmic cycle is largely dominated by increasing dissolution. For much of each Great Year neither man nor the world remembers God's instructions because the world is destined by and large to "travel on without God."

The Road of Science and the Ways to God, p. 340

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... ancient Greek scientific thought fell prey to the lure of sweeping generalizations that sidetracked the cultivation of physics for two thousand years.

Science and Creation, p. 103

The fact that the best results of ancient engineering were used mostly for purposes of warfare or as devices of deception and magic in temples also provides a vivid illustration of a passive attitude toward nature.

Science and Creation, p. 130

... the problem of the failure of ancient Greek science is largely the failure of the Greeks of old to go resolutely one step beyond the prime heavens to a prime mover absolutely superior to it.

The Road of Science and the Ways to God, p. 320

On this point, the study of motion, which is the very soul and foundation of physics, the Greeks made no advances whatsoever.

Chance or Reality and Other Essays, p. 235

For Plato and the Greeks, the world was not created but generated, or rather begotten from a divine substance. For Christians the only divinely begotten entity was the Son, alone consubstantial with the Father, the Creator. The world in Christian perspective had to be created, that is, contingent in the deepest sense. But since creation was the act of a rational Creator, infinitely superior to a mere demiurgos, the work of creation had to be fully consistent, that is, rational. Such was the fuller perspective of the "Word became flesh," a perspective which the Greeks of old could not muster. This is why science implies much more than the Greek way of looking at the world, a way which, however rational as long as it dealt with the abstractions of geometry, was not rational enough when it came to physical reality. In the end it became the prisoner of irrationality which barred access to the novelty of a self-sustaining science, the only science worthy of its name.

Chance or Reality and Other Essays, p. 221

The Greeks failed to develop science, by which I mean an intellectual enterprise in which one discovery generates another discovery and does so at an increasingly accelerated rate ... the Greeks of old failed to make any breakthrough in the science of motion or dynamics which is the basis of all physics and which in turn is the basis of all modern exact science.

The Absolute Beneath the Relative and Other Essays, pp. 61-62

Metaphysics

Does man create reality by having ideas about it, or do ideas depend on man's registering reality?

Numbers Decide and Other Essays, p. 18

... any universal lands one in the deepest waters of metaphysics.

Numbers Decide and Other Essays, p. 59

In making scientific discoveries man patently reveals his ability to see beyond what is immediately given in the physical. Because this ability of man is metaphysical, the metaphysics of discovery imposes the rediscovery of metaphysics.

The Absolute Beneath the Relative and Other Essays, p. 52

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... for once the simplest act of knowledge is not recognized as a marvel which reveals the non-physical in the physical, a marvel to which only metaphysics can do justice, then even discoveries, these spectacular and sophisticated processes of knowledge, will fail to reassure the scientists, to say nothing of some philosophers and historians of science, about the coherence of the physical ... what matters most in science as a series of creative discoveries, which leads one to a non-material world lurking beyond a world of matter. That world is the world of God and soul, a world reached through discoveries, scientific and other, about that world which is called the physical universe.

The Absolute Beneath the Relative and Other Essays, p. 53

Epistemology

... the human mind cannot impose itself on the external world but has to surrender to the enormously high degree of the world's specificities.

Numbers Decide and Other Essays, p. 23

... reality ... is the very starting point of that episteme which alone can issue in consistent human understanding.

The Absolute Beneath the Relative and Other Essays, p. 38

Early Church

Augustine's *City of God* molded more than any other book by a Christian author the spirit of the Middle Ages. Its pages were as many wellsprings of information and inspiration for the emerging new world of Europe about the meaning of mankind's journey through time. He declared that the physical universe and human history both had their origin in the sovereign creative act of God, which also established a most specific course and destiny for both.... This book became the intellectual vehicle for a confidence which centuries later made possible the emergence for the first time of a culture with a built-in force of self-sustaining progress.

Science and Creation, pp. 177-178

[Augustine's] *City of God* ... not an argument between two live contenders but a query about the point whether the only live contender, Christianity, should be blamed for the demise of the other, the pagan Roman Empire (p. 35).

The Road of Science and the Ways to God, p. 35

Byzantine Empire

In the medieval context reason meant Aristotle. Byzantium largely skirted the issue by withdrawing its orthodoxy into a lofty supernaturalism steeped in Neoplatonism. In such a framework there was no room for science or for natural theology.

The Road of Science and the Ways to God, p. 35

Islamic Science

A thousand years ago the great Muslim mystics al-Ashari and al-Ghazzali denounced natural laws, the very objectives of science, as a blasphemous constraint upon the free will of Allah.

Chance or Reality and Other Essays, p. 242

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The Middle Ages

Whatever the popularity of Aristotelian science during the Middle Ages, the medieval nations of Western Europe did not follow Aristotle into pantheism, precisely because their Christian faith kept alive in them a vivid need of God.

The Origin of Science and the Science of Its Origin, p. 11

The important point for the historian of science is that Aquinas gave to a broadly shared rational conviction a concise formulation which had symbolic power.... He (Aquinas) noted that it is natural for man to be in cognitive unity with nature.

The Road of Science and the Ways to God, p. 37

The contingency of the universe obviates an a priori discourse about it, while its rationality makes it accessible to the mind though only in an a posteriori manner. Hence the need for empirical investigations. The contingency of the universe as a whole serves in turn as a pointer to an ultimate intelligibility which though outside the universe in a metaphysical sense, is within the inferential power of man's intellect.

The Road of Science and the Ways to God, p. 38

Aquinas, although compromising with Aristotle in many ways, differed from him in three ways: the existence of a transcendent God, the creation out of nothing, and the freedom of man rooted in the immortality of his soul.

The Road of Science and the Ways to God, p. 39

Nicholas of Cusa's real contribution to science are in some of his opuscula, in which he time and again ties the need for quantitative accuracy to the words of the Book of Wisdom about the Creator having arranged everything according to weight, measure, and number.

The Road of Science and the Ways to God, p. 44

While biblical monotheism owed nothing to Greek science, that science could develop into a true science only within a monotheistic matrix, which happened to be biblical through the mediation of Christianity.

The Road of Science and the Ways to God, p. 153

Inertia, momentum, conservation of matter and motion, the indestructibility of work and energy—conceptions which completely dominate modern physics—all arose under the influence of theological ideas.

The Road of Science and the Ways to God, p. 157

It can indeed be said without exaggeration that the Western world lived until the advent of the steam engine on technological innovations made during the medieval centuries.

Christ and Science, p. 22

Half a century has passed since these words startled a distinguished audience at Harvard University and indeed the whole intellectual world. The magnitude of the shock merely corresponded to the impenetrable density of a climate of opinion for which the alleged darkness of the Dark Ages repre-

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sented one of the forever established pivotal truths of the ‘truly scientific’ interpretation of Western intellectual tradition.

Responding to the remarks by Alfred North Whitehead on the “medieval insistence on the rationality of God,” *Science and Creation*, p. 146

It was then [Middle Ages], in an age steeped in the Gospel, that man was able to convince himself that since both means and purpose are the products of the Creator’s wisdom, they cannot be irreconcilable no matter how disparate and mutually exclusive they may appear. It was that conviction inspired by the Gospel that made possible that science in which data wholly devoid of purpose are investigated for a purpose that can only be recognized through a vision which man alone is able to achieve.

The Origin of Science and the Science of Its Origin, p. 106

The ultimate in intelligibility was first placed firmly on a level transcending both man and nature during the Middle Ages and in a way that constituted a cultural matrix. It manifested a broadly shared conviction that a personal, rational, and provident Being, absolute and eternal, is the ultimate source of intelligibility insofar as He is the Creator of all things visible and invisible.

The Road of Science and the Ways to God, p. 34

Today it no longer passes for unquestionable scholarship to speak of the darkness of the Middle Ages.

Chance or Reality and Other Essays, p. 27

Copernicus

He aimed for conceptual (not computational) simplicity based upon his faith in the Creator’s power and simplicity.

The Road of Science and the Ways to God, p. 46

Copernicus was possessed of a metaphysical vision of mathematics as well as of nature.

The Road of Science and the Ways to God, p. 56

Copernicus, Kepler, Galileo, and many others derived from their Christian faith to see a divine simplicity in the apparently irregular flow of phenomena.

The Origin of Science and the Science of Its Origin, p. 102

When historians are baffled by what [Morris Kline identifies as “the religious convictions that formerly motivated some of the finest research,”] it is because they “have never experienced what it means to look at the world as the product of a personal, rational Creator. But if they wish to function as discriminating historical scholars, they must make a sustained effort to describe the mental world of a Copernicus, a Kepler, or a Galileo, not in terms of twentieth-century unbelief but in terms of a belief that was an integral and fundamental part of their mental physiognomy.”

The Road of Science and the Ways to God, p. 47

Galileo

Unlike Archimedes, they (the forerunners of Galileo) applied, from almost the very start, geometry to problems of motion. Such a contrast will not be understood unless one keeps in mind the con-

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trast between Plato's god; who merely cultivated geometry, and the God of Christian theism, who created everything according to weight, measure, and number even in a world of motion.

The Road of Science and the Ways to God, p. 48

The creative science of Galileo was anchored in his belief in the full rationality of the universe as the product of the fully rational Creator, whose finest product was the human mind, which shared in the rationality of its Creator.

The Road of Science and the Ways to God, p. 106

Galileo took the human mind for the Creator's finest product, created to His very image and therefore equipped to fathom at least in a quantitative way all His other products.

The Origin of Science and the Science of Its Origin, p. 104

In the 1930s it was pointed out the Galileo never dropped weights from any tower and that he had derived the time-squared law of free fall long before he experimented with balls and inclined planes.

The Road of Science and the Ways to God, p. 230

Kepler

... heroic groping of a great man of science with facts, with ideas, with perspectives, and not least with the need to arrive at a law which enabled the prediction of planetary positions with the greatest possible accuracy.

The Road of Science and the Ways to God, p. 152

Descartes

d'Alembert put the blame squarely on Descartes for that stagnation in which physical science remained for some time in France while it advanced rapidly in England.

The Road of Science and the Ways to God, p. 65

Berkeley's categorical denial of the existence of an external world is often presented as the necessary end of Cartesian logic.

The Road of Science and the Ways to God, p. 77

Newton

He insisted on the need of a nonmechanical ultimate cause of mechanical patterns.

The Road of Science and the Ways to God, p. 83

In addition to very unorthodox theological views, Newton also had a biblical, Puritan upbringing from which he retained a feeling of awe for the Creator and Ruler of all.

The Road of Science and the Ways to God, p. 89

In him, we see the use of the mind which transcended empiricism without being trapped in a priorism.

The Road of Science and the Ways to God, p. 90

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Newtonian science was the product of a truly inventive intellect pondering the witness of the senses.
The Road of Science and the Ways to God, p. 119

The vision of the world it embodied was ultimately a creation of the mind, a leap from sensory data far beyond the range of the sense. But because that vision was rooted in data provided by nature, the vision could become a vigorous science. It was so vigorous and fruitful that the physical science of the next two centuries became an ordinary science busy with unfolding the potentialities of the creative science of *The Principia*.

The Road of Science and the Ways to God, p. 87

[Regarding apostasies of the human mind]—the repeated yielding to pleasing but obvious fallacies taken for basic frameworks of explanation. Such a fallacy was at work when Newtonian physics was taken for the proposition that everything is machine; another is at work when relativistic physics is taken for the claim that everything is relative; still another is at work when quantum mechanics is taken for a denial of causality.

Chance or Reality and Other Essays, p. 240

Newton's greatness lies, first, in his claim that his laws of motion are universally valid and, second, that he had shown something of that universality. I mean his proof that the motion of the moon is governed by the same acceleration as is the fall of an apple or stone to earth. This coupling of the earth and of the moon was a bold step into the universe of things. It revealed in a single stroke the very essence of science, which is the universal applicability of its laws.

The Absolute Beneath the Relative and Other Essays, pp. 63-64

Hume

In Hume's rendering, paganism is the embodiment of tolerance, of freedom of thought, and the fostering of man's good instincts. Christianity, with its commitment to a transcendent personal God, is the hotbed of fanaticism, the fountainhead of debasing asceticism, and the mainspring of the enslavement of the mind.

The Road of Science and the Ways to God, p. 102

Denied anything objective in the relations of cause and effect (the very thing which all physical science is engaged in discovering particular cases thereof).

The Road of Science and the Ways to God, p. 154

Kant

Built an edifice of sheer fantasy.

The Road of Science and the Ways to God, p. 115

His *Critique of Pure Reason*—the gospel of pure subjectivism.

The Road of Science and the Ways to God, p. 128

If the structure of the mind determines the structure of things that are outside the mind, then the *raison d'être* for experimenting and observation will hardly ever become a compelling reason.

The Road of Science and the Ways to God, p. 128

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... one's knowing is meaningless unless one knows something, that is, unless one's knowledge touches on reality. Elementary as this truth may appear, it has been stolen from Western rationality ever since Kant made his mark. Being heirs to that intellectual larceny, Bohr and his followers tried to understand not reality but only our understanding of reality and in the process Bohr was driven, as Hooker remarked, "toward the twilight zone of mere appearances." A world of appearances is most germane to oriental mysticism, and Bohr's categorical rejection of ontology was rightly seen as a telltale aspect of his basic sympathies with that mysticism.

The Road of Science and the Ways to God, p. 212

Hegel

In making their (Copernicus, Galileo, Newton) discoveries they saw in the newly unfolding lawfulness of nature not the traces of their own minds but the vestiges of the Creator's mind. For them the world was an objective entity, and they would have had only scorn for Hegel's seeing in their feats the triumph of "the independent authority of Subjectivity."

The Road of Science and the Ways to God, p. 142

... the belief in creation and the Creator ... formed the bedrock on which science rose. It is a telling reflection on the tragic instability of human thought that, a century or two after the rise of science, its true origins could be ignored or fiercely attacked by so many gifted minds.

The Road of Science and the Ways to God, p. 143-144

The idealists equipped the mind with illusory wings to enable it to leave forever the realm of the sensory.

The Road of Science and the Ways to God, p. 152

Positivism

Confined the flights of the mind to the realm of the sensory.

The Road of Science and the Ways to God, p. 152

The most varied phenomena can be reduced to the same mathematical formalism: the attraction of electric charges, the attraction of masses, the intensity of light (all diminish according to the inverse square law). No physicist of any consequence drew the conclusion that the diversity of such phenomena was therefore an illusion, a conclusion that is inevitable on the basis of logical positivism.

The Road of Science and the Ways to God, p. 222

All true creative physicists have had a creed very different from the dogmas of logical positivism concerning the ability and role of the mind, and all of them acted, that is, made their discoveries, by living up to the tenets of that creed of theirs.

The Road of Science and the Ways to God, p. 246

... none of the giants of science from Copernicus to Einstein and beyond did their science in such a manner as to fit the precepts of empiricism... Studies of the great scientific discoveries also showed that minds responsible for them always had to cope with the absence of important empirical details, an absence which from an empiricist viewpoint could only invalidate what was perceived as a broader and deeper truth about nature.

The Road of Science and the Ways to God, p. 249

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Enough is known about the puzzlements of such professedly nonmetaphysicist physicists, like Bohr, Born, Heisenberg, and Dirac, to permit one to shrug off the empiricists' interpretation of twentieth-century physics—which also has on its roster Schrödinger, de Broglie, Compton, and others whose votes were never cast in favor of empiricism. All the great figures of exact science gave the lie, if not with their words at least with their deeds, to an empiricism restricting the reach of the mind to what is directly observable. Whether they peered into the realm of the very small or of the very large, they were led by the conviction that greater than what is seen through an instrument is the act of looking through it. It was their confidence in the act of looking, in which the sensory reveals the rationality of its objectivity, that made them follow a Copernicus in reaching out for the vistas of a coherent universe, a target which empiricism cannot secure. Like Copernicus, they had fear only of those willing to use but their physical eyes. Theirs has always been that assurance about the ability of the mind to find an ever-deeper rationality in the physical universe which can be felt on every page of the introduction of Copernicus's *De revolutionibus*—an assurance they had to have if they were to succeed in unfolding that deeper rationality. Its objectivity was one side of a coin and the other side was their personal commitment to it.

The Road of Science and the Ways to God, p. 249

The Universe a totality of coherent things and processes.

The Road of Science and the Ways to God, p. 249

Students and lovers of natural theology might reflect with profit on the inability of so many scientists of our times to extricate themselves from the snares of positivism, in spite of the monumental lessons provided by the creative science of Planck and of Einstein.

The Road of Science and the Ways to God, p. 195

Quantum Mechanics

Planck's constant, h , 6.885×10^{-27} erg-sec (the only decoration of his tombstone), made possible the derivation of units for mass, length, time, and temperature—a reflection of Planck's sustained commitment to objective reality independent of the human mind. His bedrock: an objectively existing nature as embodiment of absolute truths which formed the very core of quantum of science.

The Road of Science and the Ways to God, p. 173

Science had its consistent unity, Planck remarked, because the universe was one and could only be one if it was truly a universe.

The Road of Science and the Ways to God, p. 176

Planck—not overt in his Christian faith (said prayers; even acted as a Lutheran elder)—“While from youth on I was deeply attuned to the religious, I do not believe in a personal God, let alone in a Christian God.” He never perceived the measure of his debt to that heritage [Christianity]. To the end he waged a spirited crusade on behalf of a world view distinctly metaphysical and ethical, without seeing that it made logical sense only if the world was the product of a rational, personal Creator, a notion maintained by historic Christianity and from which the republic of science received crucial benefit. He did not see that this world view, this faith in the enduring rationality of the cosmos made sense only as long as the world, its laws, and (not least) its constants were given in the deepest ontological sense.

The Road of Science and the Ways to God, pp. 179-180

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Most of the cultivators of quantum mechanics, contra Einstein, rejected the notion that reality existed independently of the observer and of causality.

The Road of Science and the Ways to God, pp. 198-199

Bohr and his Copenhagen school shifted to an Eastern cultural mentality in their explanations of quantum mechanics.

The Road of Science and the Ways to God, p. 204

The Copenhagen interpretation is, however, not so much a derivative of quantum mechanics as a fashionable dress forced on it.

Chance or Reality and Other Essays, p. 28

Heisenberg ... made the fallacious assumption that the knowledge of reality was equivalent to measuring it..

The Road of Science and the Ways to God, p. 209

Backbone of matrix mechanics—noncommutative algebra [a scheme developed by pure mathematicians long before the advent of atomic physics].

The Road of Science and the Ways to God, p. 210

Quite a few physicists believe that they can do more with reality than merely redefine it. That material reality is the product of space-time geometries and that even the whole universe issued out of a non-commutative algebraic operator, or, more picturesquely, out of a mere quantum flip, are the not-too-esoteric forms of some prominent physicists' belief that reality is the product of the mind.

The Absolute Beneath the Relative and Other Essays, p. 19

In quantum mechanics, where all basic operations are statistical, probability proved itself useful beyond the most sanguine expectations. It was another matter to use that usefulness as a cover-up for casting doubt on the coherence of the universe at its fundamental level, nay, on existence itself. The gist of that procedure was a systematic refusal to consider questions of ontology. Indeed, in that procedure accidental or chance events stood opposed not to determinate events, but simple to reality itself.

The Absolute Beneath the Relative and Other Essays, pp. 37-38

Einstein

In the cosmic religion professed by Einstein there was no room for creation or Creator.

Cosmos and Creator, p. 4

Relativity—instead of relativizing everything, it unfolded absolute, objective aspects of the physical world.

The Road of Science and the Ways to God, p. 183

By asserting the need for hidden variables in physical theory Einstein wanted to vindicate the objective, fully determined causal layer of entities underlying the surface level of measurements where everything seemed to be indeterminate and therefore statistical.

The Road of Science and the Ways to God, p. 209

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The creative science that drove an Einstein toward a world view was in its very core identical to the one held by Maxwell, Faraday, Euler, Newton, Galileo, Kepler, and Copernicus insofar as objectivity and order were concerned. Hence one may suspect with good reason a fair measure of identity to be present in science throughout its cultivation from Copernicus to Einstein.

The Road of Science and the Ways to God, p. 241

“... the very fact that the totality of our sense experiences is such that by means of thinking ... it can be put in order ... is a fact which leaves us in awe, but which we shall never understand.”

The Road of Science and the Ways to God, p. 259

Much as some ideas may appear to be free creations of the mind, Einstein knew that they had to be continually referred back to the empirical for at least an indirect verification. Without that verification even his general relativity could turn, as he put it in 1920, “into mere dust and ashes.”

The Road of Science and the Ways to God, p. 260

Education

Pluralism in education has become a shibboleth and something worse, a palliative to work magic ... radical pluralism is the absence of meaning.

Numbers Decide and Other Essays, p. 67, 77

Wisdom seems to have lost out in an education that stressed pluralism, not only of subjects but also of viewpoints so that the really essential ones may be conveniently ignored.

Numbers Decide and Other Essays, p. 74

... when electric power fails and too many office workers with keyboards and monitors in front of them that “are down” are unable to continue with simple arithmetic operations that constitute billing. Therein lies a proof, if proof is needed at all, that the addition as a mechanical operation hangs in mid-air if it is not supported by the kind of mental operation which is to count in the head. Head skillful in doing such operations were a dime a dozen fifty years ago in the United States when even cash registers were a rarity in many a five and ten cent store. Addition of at times long columns of figures was done with striking speed and accuracy by people at the checkout counters who had only a pencil and a notepad in their hands, but an old-fashioned grade-schooling behind them. Today such people are rarely found among those who operate the check-out points of supermarkets.

Numbers Decide and Other Essays, p. 76

Verbal sophistication can be tantamount to sorcery with words.

Numbers Decide and Other Essays, p. 78

No tragedy could be acted out with greater farce when the traditional three R's, Reading, 'Riting and 'Rithmetic, are slighted in our schools. Meanwhile Reason and Rod, the two dutiful acolytes of the three R's, are forbidden to appear on the school-grounds.

Numbers Decide and Other Essays, p. 78

Education is caught in an intellectual pandemonium up to its ears as it resounds to the claim, subtle or crude, that everyone is entitled to one's universe and this is what all education should be about. This claim is, of course, a deception in logic. It is no less hollow than the claim that everything is

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relative and this is the only absolute truth. The claim that everyone is entitled to one's universe is a unitary proposition. There is nothing plural to it. It asserts the same about each and every individual. Further it assumes that all individuals constitute one single class or else the claim becomes meaningless. This alone should suggest that the kind of pluralism which is at the heart of the so-called "student-centered learning" has much deeper limits than its protagonists may suppose. In fact any word poses a devastating challenge to that pluralism. For every word is a universal and it remains so even though most moderns prefer not to take note of this while they are spouting their words in defense of pluralism ... it is ultimately the one that rules the many and not the other way around ... every mind is a witness to the absolute which is unity itself, because it is universally true.

Numbers Decide and Other Essays, pp. 81, 83

... the universe and the university cannot be foreign to one another. A university as an institution was born in the belief (a belief specific to the Middle Ages) that it is meaningful to search for universal knowledge, precisely because there is a universe, that is, a coherent totality of things and minds. Are universities still such institutions, or have they degenerated into places of entertainment where non-science students are initiated into twentieth-century cosmology through courses in which the mythology of extraterrestrial intelligence is presented with all the dazzling glamor of audio-visual techniques as the latest in respectable and reliable science?

Chance or Reality and Other Essays, p. 193

In all likelihood only a minority of universities, committed by their statutes and strengthened by their loyalty to those statutes or hallowed mottos, will teach not only information but also meaning, that is, true integral humanness.

Chance or Reality and Other Essays, p. 198

Artificial Intelligence

Herein lies the worst fallacy of the whole modern discussion about computers as artificial intelligence. Machines do not add, they do not calculate, they do not integrate any more than a gutter does not *add* or integrate by being the channel for millions of raindrops. In an electronic computer not raindrops but electronic impulses are channeled along strictly predetermined routes. In the process no addition is performed. It takes a mind, always a mind, to abstract meaning from each step through which the machine is directed by its specific man-built mechanism.

The Absolute beneath the Relative and Other Essays, p. 82

Mathematics

... God "arranged everything according to measure, number, and weight" (Wisdom 11:20) and ... he made man in His image, endowing him thereby with a mental ability to see precisely this arrangement.

Numbers Decide and Other Essays, p. 39

Equations are a set of numbers, or rather numbers or quantities that are to replace any letter of the alphabet that occurs in those equations. Only then do those equations perform the function proper to them, that is, yield quantitatively exact results that are also predictive about similarly quantitative features of a physical reality ... the exact formulas and measurements remain in themselves mere numbers, devoid of any physical reality. To his philosophical discredit the physicist may attribute a metaphysical existence to numbers and formulas, but that existence remains locked up in a concep-

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tual stratosphere separate from physical reality, the reality which alone out to be of final interest for science.

Numbers Decide and Other Essays, pp. 38-39

... it is not quantitative relations that give physical meaning to physical science, but some clearly non-quantitative perceptions, judgments, and conclusions.

Numbers Decide and Other Essays, p. 37

... according to modern physics relatively very few are the numbers that impose themselves on the physicist as he tries to measure nature and coordinate his data into a mathematical whole.

Numbers Decide and Other Essays, p. 23

... the mathematicians and especially the geometry that the scientists of Galileo's time held in such high esteem was not considered by them a free creation of mind but rather a pattern to be learned from observation of the actual contours of nature.

The Relevance of Physics, p. 101

It is there, in an immensely variegated nature and not in his finite intellect where ultimately lies the never-ending challenge for the mathematician.

The Relevance of Physics, p. 131

The concreteness of nature, however, is rich beyond comprehension in aspects and features. This is why even the most bizarre sets of mathematical postulates and geometrical axioms can prove themselves isomorphic with some portion of the observational evidence and useful in systematizing it.

The Relevance of Physics, p. 121

For one thing, Gödel's theorem casts light on the immense superiority of the human brain over such of its products as the most advanced forms of computers. Clearly, none of these machines can ever yield an answer comparable in its breadth and depth to Gödel's theorem. For another, despair can grow only in a soil where a rigid rationalism has already killed off the seeds of intellectual humility. Such a soil cannot nurture the recognition that there is no escape from admitting that in mathematics and *a fortiori* in physics certainty is not the fruit of a "pure rationalistic" procedure alone.

The Relevance of Physics, pp. 129-130

Some theoreticians ... hope to construct a mathematical physics which would be equivalent to showing that the structure or specificity of the universe can only be what it is and nothing else. Such hopes ... should be viewed as logically impossible, as long as Gödel's incompleteness theorem is valid. In other words, the specificity of the universe will remain the kind of specificity which keeps reminding any sensitive mind that it is not a necessary but a contingent feature, a specificity which does not have its *raison d'être* in itself, but must depend on a choice external to the universe.

Chance or Reality and Other Essays, p. 193

The intrinsic merits of the goal of devising an ultimate physical theory should also seem nil as long as the theory is sufficiently mathematical, which such a theory certainly has to be. Now Gödel's incompleteness theorem states that the proof of consistency of any non-trivial set of mathematical axioms can be found only outside that set, and in that sense no mathematical system can be an ultimate system. In other words, whereas General Relativity forces us to admit the realistic character of

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the notion of consistently interacting things, as a valid object of scientific cosmology, the application of Gödel's theorem to cosmology shows that a disproof of the contingency of the universe is impossible. The mental road to the extracosmic Absolute remains therefore fully open.

The Absolute Beneath the Relative and Other Essays, pp. 12-13

Only a limited range of the full reality of things can ever be accommodated in the molds of mathematics, advanced and esoteric as these might be.

The Relevance of Physics, p. 135

One is, in fact, caught in a process of endless regression when trying to formalize a metamathematical theory of proof as a set of symbols manipulated according to specified rules. Each set of rules points beyond itself for its proof of consistency. This is why one has to consider dim the prospect of mathematics ever becoming established as the system of "absolute truths."

The Relevance of Physics, p. 128

A proposition of mathematical physics ... can even disclose previously unsuspected phenomena of nature, a prerequisite for achieving control in greater depth.

Cosmos and Creator, p. 28

[Maxwell's electromagnetic equations] are "possibly the most beautiful equations until then formulated in theoretical physics.

Cosmos and Creator, pp. 31-32

Photographs taken of distant galaxies turned into common knowledge a magnificent variety of patterns that are not a whit less beautiful than snow-flakes and crystals under magnifying glasses ... the models of atoms and molecules ... give a glimpse of the intricate beauty of the world of atoms.

Cosmos and Creator, p. 29

The value in question is the effectiveness of mathematical formulae to co-ordinate the known phenomena of nature and to provide increasingly wider control over them.

Cosmos and Creator, p. 28

While a mathematician need not even be partially sane and can say whatever he likes within the limits of consistency, the mathematician cannot help wondering why of all his consistent systems only one fits the physical universe.

Chance or Reality and Other Essays, p. 34

The most overrated and at the same time most explosive symbol of mathematics is that equation sign which states that nothing happens unless something is already happening.

Chance or Reality and Other Essays, p. 198

The vision [Einstein's vision of nature—JN] was that of a cosmic reality, fully coherent, unified and simple, existing independently of the observer, that is, not relative to him, and yielding its secrets in the measure in which the mathematical formulae through which it was investigated, embodied unifying power and simplicity.

The Absolute Beneath the Relative and Other Essays, pp. 7-8

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Herein lies the ultimate bearing of Gödel's theorem on physics. It does not mean at all the end of physics. It means only the death knell on endeavours that aim at a final theory according to which the physical world is what it is and cannot be anything else. Gödel's theorem does not mean that physicists cannot come up with a theory of everything or TOE in short. They can hit upon a theory which at the moment of its formulation would give an explanation of all known physical phenomena. But in terms of Gödel's theorem such a theory cannot be taken for something which is necessarily true. Apart from Gödel's theorem, such a theory cannot be a guarantee that in the future nothing essentially new would be discovered in the physical universe which would then demand another final theory and so on. Regress to infinity is no answer to a question that keeps generating itself with each answer. Gödel's theorem means, among other things, that physicists who aim at reading God's mind will not succeed, because they cannot read their own minds in the first place. A physicist, Paul Davies, who writes a book with the title *The Mind of God*, should be the object of pity and not the recipient of a prestigious prize for progress in religion. Gödel's theorem remains a serious assurance to all physicists that their minds will forever be challenged by ever fresh problems. With a recourse to logic they would also know what to think of efforts to derive the very specific constants of physics from non-specific considerations. Insofar as mathematics works with numbers, it will remain steeped in specifics all of which raise the question: Why such and not something else? It is that question which keeps the mind awake, or rather is raised by minds not prone to slumber.

From an Internet essay, "A Late Awakening to Gödel in Physics" (2004)

The Pythagoreans were in a sense the first physicalists. They claimed that everything was composed of unit lengths. But the hypotenuse of a right-angled triangle with unit sides is not another unit of integers, but the square-root of two, an irrational number. It is a privilege and marvel of the mind to find rhyme and reason even in what may appear irrational. It is the privilege of the human mind to take for real what became known as imaginary numbers ($i = \sqrt{-1}$ —JN). Only the human mind can imagine, that is, perceive meaning under the layer of sense data. Only the human mind can grasp facts and also muster intellectual respect for them. In this attitude of respect, which is definitely not machine-like, is comprised the whole dignity of man. Perception of truth is only part of the story: man also must respect facts and truths to survive and to make progress.

The Absolute Beneath the Relative and Other Essays, p. 83

Statistics and Probability

That nothing happens by accident is, of course, a chief tenet of Christian religion, according to which not even a sparrow falls to the ground, or a hair is bent on our head, without our Heavenly Father willing it. That nothing happens by accident—that is, by sheer chance, that is, really without a cause—is also a chief tenet of science about the material universe. For if anything were truly accidental, there could be no consistency, and without consistency there could be no laws, not even statistical laws, because even they imply one or two parameters which imply consistency.

The Absolute Beneath the Relative and Other Essays, pp. 68-69

Arithmetic

... quantitative proofs ... rest on our ability to count and to do arithmetic in a consistent way. As consistency presupposes laws, counting too makes sense only if it is done according to some laws of arithmetic. Depending on the extensiveness of the arithmetic one uses, its laws too form a more or less extensive set. This set also must have its proof of consistency or else 2 and 2 will not always and

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necessarily make 4 and the whole enterprise will collapse. In 1930, Gödel proved that no sufficiently broad set of laws of arithmetic can have its proof of consistency within itself. To have the proof, one must reach out for assumptions lying outside the set and to prove the consistency of these assumptions, one must rely on still further assumptions. This means that to prove the consistency of quantitative science one must rely on considerations which the prevailing jargon calls metaquantitative or metamathematical. In older times, when there was till more courage to call a spade a spade, one would have said not metamathematical but metaphysical.

The Absolute Beneath the Relative and Other Essays, pp. 81-82

Some of the many scientific works by Stanley L. Jaki (by date of first publication)

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- (1974) *Science and Creation: From Eternal Cycles to an Oscillating Universe* (Edinburgh: Scottish Academic Press), 367 pp.
- (1978) *Planets and Planetarians: A History of Theories of the Origin of Planetary Systems* (Edinburgh: Scottish Academic Press), 266 pp.
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