

Is science really incompatible with any religious belief?

Alessandro CORDELLI

Pontifical Lateran University, Roma, Italy

Abstract

Modern scientific thought has introduced a separation between science and religion which was unknown to classical and medieval philosophers. Indeed, God's action has been often used to "fill the gaps" of rational explanation of natural phenomena. So, as positive science achieved resounding success in the past four centuries, God seemed to become a needless hypothesis. Today, many scientists share agnostic or atheistic positions, notwithstanding the crisis of determinism occurred with the quantum revolution and the theory of complex systems. After a detailed analysis it comes out that such positions rely on some controversial epistemological assumptions, an understanding of God's character contrary to the main spiritual traditions, a (onto)logical mistake in considering the problem of initial conditions of the Universe. From such an analysis, a clear view of the problem comes out and a correct relation between religion and positive science can be established. In particular, the creative intervention of God is purely transcendental, regarding the plane of existence. On the other hand, physical laws completely explain how the phenomena occur, but they cannot anyway justify the existence of the material reality as a whole.

1. Introduction

A large part of the scientific community as well as of the public opinion (even if not – presumably – the majority) share the conviction that the worldviews of positive sciences and religion are not compatible. In a paper¹ with the significant title "Why (Almost All) Cosmologists are Atheists" the outstanding American physicist Sean Carroll support the thesis

¹ Sean M. Carroll, *Why (Almost All) Cosmologists are Atheists*, prepared for *God and Physical Cosmology: Russian-Anglo American Conference on Cosmology and Theology*, Notre Dame, January/February 2003; <http://www.preposterousuniverse.com/writings/nd-paper/>

that if we apply an objective scientific method to discriminate between fundamental pictures of reality, we are led to accept a materialistic conception of the universe. The problem discussed in Carroll's paper (and in the present paper) is about the existence of God, an ancient question to be constructively confronted with recent acquisitions of fundamental research, especially in cosmology.

Even if the argumentations devoted to support a materialistic worldview are rigorous and exposed in a clear way, they are intrinsically weak; the aim of this paper is to show that there is no incompatibility between religious belief and an objective analysis of the scientific results; rather, a transcendent level of reality is required on ontological ground to avoid the contradiction of a universe without a cause for its existence.

The main points we'll take into account are: the controversial epistemological background underpinning atheistic positions, a God's conception quite distant from the one of the main religious traditions, the misunderstanding of the roles of ontological and chronological planes in discussing the problem of universe's origins.

Moreover, from these considerations emerge the features of a correct relation between science and religion, i.e. physical laws completely explain material reality but they cannot justify themselves, so a creative principle beyond space and time is required to give comprehensibility to the world we inhabit.

2. At the root of the controversy

In such a delicate question as the one we are dealing with, a preventive accurate discussion about the terms we use is mandatory. There are in fact couples of nouns which are often opposed to each other. On one hand there is *metaphysics, spirituality, belief, faith, religion*; on the other side we find *rationality, science, reason*. We can ask ourselves whether such oppositions really hold in any case or not and, however, if they are so irreducible. For example, spirituality means the whole of immaterial human activities, and no doubt that rational thought is one of the highest of such activities. Then, spirituality does not oppose to rationality, rather comprises it. Moreover, the decision to adhere to a particular religion is

taken on the basis of rational considerations because some of the arguments taken into account are evaluated as the most convincing. When we accept one or another religious tradition we behave in the same way as when we trust a witness who tells us about a fact we have not directly seen².

Of course, such a choice cannot be forced by mandatory arguments as in the case of an experimental result or a theorem's demonstration, but it is however based on rational considerations. The prerequisites for this evaluation process are two: a worldview that accepts a transcendent level (i.e. a creative principle which is the cause of the whole universe's existence) and the witness' trustworthiness; without these prerequisites the faith is much similar to superstition. The latter condition lies on contingent and historical grounds, but the former is based on inferential arguments and constitutes the large part of metaphysics. In other words, before we choose a particular revelation of God we must accept the fact that a God exists. It is a matter of existence, and it is the common ground where science, philosophy and religion can meet.

There are several arguments developed during the centuries to prove God's existence. One important class of them is based on the most celebrated "ontological proof" by St. Anselm of Aosta³ according to which God is the one of which nothing greater can be thought, often indicated as IQM, from the Latin statement: *id quo maius cogitari nequit*. If IQM would exist only in thought, it wouldn't be really IQM, because any being existing in the reality is greater than a being with the same characteristics but existing only in thought. After Anselm many philosophers developed this argument; among the others Descartes, Leibniz and, more recently, Gödel.

The ontological proof gives no possibility of a fruitful encounter with science, since it makes no reference to aspects of material universe, but is entirely contained in the plane of logical inference starting from a given definition of God.

² Antonio Livi, *Philosophie du sens commun. Logique alétiqque de la science et de la foi*, L'Age d'Homme, Lausanne-Paris 2004.

³ Anselm of Aosta, *Proslogion*.

Quite different is the case of the so-called cosmological proofs. These arguments are already present in Plato⁴ and Aristotle⁵, but they are fully developed in the “five ways” of St. Thomas Aquinas, especially the first two⁶. The key idea is very simple: everything in the world undergoes to continuous change, and changes are caused by other things, produced by other processes, caused by other things, and so on... To avoid contradiction there must be a first ring in this chain whose cause doesn't belong to material universe (otherwise there would be the problem of its cause). This being, transcending physical reality, plays the role of cause the whole universe's existence, and it seems quite reasonable to call it “God”. Of course, this apparently simple reasoning strongly impacts on many issues in physics and logic and theoretical philosophy; therefore this is exactly the field where a productive debate can take place.

3. Criticism from materialistic side

Many of the arguments supporting the atheist point of view are based on the consideration that there is no need of God to obtain a consistent picture of the world⁷. This is an important point: nobody has ever tried to demonstrate that God does not exist, the strongest statement in this sense is that He is a needless hypothesis. Accordingly, it would be better to identify the materialistic position as agnostic, rather than atheist.

The criticism is based on a number of assumptions, both of epistemological, ontological and theological kind. These assumptions form the base of the materialistic worldview, so it is better to analyze them before we see the arguments against religious belief in detail.

⁴ Plato, *Timaeus*.

⁵ Aristotle, *Metaphysica*, XII, 6.

⁶ Thomas Aquinas, *Summa Theologiae*, I, q.2, a.3; *Contra Gentiles*, I, c. 13; *Compendium Theologiae*, c. 3.

⁷ See, for example, Richard Dawkins, *The God Delusion*, Houghton Mifflin, Boston 2006, III.

3.1 Bases of materialism

Every philosophical system must face with the problem of universe, man and what is (if any) beyond the physical reality. Materialism provides interpretative tools for the investigation of the universe, an anthropology and a concept of God (the two last points are hardly disentangled, since religion is viewed as an essentially social and cultural phenomenon). Let's examine these different aspects separately.

3.1.1 Epistemology

The materialistic picture of the universe is essentially based upon the assumption that a formal model of the reality does exist⁸, which is coherent (no contradiction can be derived inside it) and complete (it takes into account every observable fact). Such a model must have a mathematical structure, in the sense that its elementary objects are entities formally defined within a given mathematical theory. Theoretical physics gives us a lot of examples: many-variable functions of wave mechanics, velocity fields of fluid dynamics, point-like particles of statistical mechanics and many others. Such entities are related by patterns, or nature laws, which dramatically constraint the possible configurations accessible to the structure; in other words, not all the transformation processes can take place, but only the ones allowed by the proper laws.

Moreover, a set of boundary conditions is required in order to determine the actual time evolution of the universe, since physical laws alone don't allow it. In fact, in physical theories the laws are expressed as differential equations, and a differential problem remains indeterminate if boundary conditions are not specified. However, according to the recent developments of cosmology, the logical distinction between physical laws and boundary conditions is not so sharp, in the sense that at the very beginning of the universe these two aspects may have strongly affected each other.

Once a formal system, the physical laws within it and a set of boundary conditions are established, in order to complete

⁸ Sean M. Carroll, *cit.*

the description an interpretation is required, i.e. a correspondence between variables in the model and observable quantities in real world.

These features define the materialistic picture of reality, a picture into which concepts as “cause” or “purpose” have no place as primary categories. In other words, the role of causality is limited to the correlation between initial conditions and dynamical evolution of a system (much alike to the position of the XVIII century empiricist philosopher David Hume, who reduced causation to the simple temporal contiguity between two events⁹), while the one of finalism concerns only human and animal behaviour.

Only physical laws do really exist, and physical laws describe how processes go on, not explain why they occur. In other words, ontology completely disappears from the horizon of the materialistic picture: the complete description of a system fully justifies its concrete existence.

Also finalism is in this view a derived concept. Man recognizes the realization of a project in natural development of more and more complex structures, but this is an illusion due to the analogies with human activities. Complexity arise from physical laws and, in the materialistic view, no backward causation from final states can condition the evolution processes.

Two main consequences derive from the materialistic picture. First: since physical laws and boundary conditions uniquely determine the evolution of a system and the model of the world – being a mathematical model – has an inferential structure, everything is computable or, better, algorithmically computable (in the sense of the Church-Turing thesis¹⁰). Nevertheless, many processes appear to be non computable, even in principle. In particular, at subatomic level there are physical quantities that cannot be calculated neither measured (e.g. velocity and position of an electron at the same time) according to Heisenberg’s indetermination principle. But, when this happens, it is only because we ask the nature “the

⁹ David Hume, *A Treatise of Human Nature*, I, III, 3.

¹⁰ According to Church-Turing thesis, every function which would naturally be regarded as computable, is computable by means of an algorithm implemented on a programmable device, as a computer.

wrong question”: searching simultaneously velocity and position of an electron simply makes no sense. This viewpoint is the so-called Copenhagen interpretation (named by the group of scientists gathered around Niels Bohr at the University of Copenhagen) of quantum mechanics, a strongly empiricist position which acknowledges no physical reality to the microscopic unobserved level, the only reality being that of the classic world within which the experimenter’s apparatus finds its home¹¹. Opposite to this viewpoint we find the one supported – among the others – by Einstein, who never accepted quantum indeterminism and aimed to save classical determinism. To justify this position he conceived a celebrated *gedanken experiment* which led to a paradoxical situation¹². According to his proposal, the paradox is solved if we admit that quantum mechanics is an incomplete theory, to be completed by means of some parameters, to be discovered in the future but at the present still unknown and to be considered as hidden variables. Further developments, both theoretical¹³ and experimental¹⁴, showed that Einstein was wrong and hidden variables do not exist: nature at its very level is genuinely quantum-like.

Second: composed structures can be a completely described in terms of their constituents and relations between them. Conversely, no information about an element can be inferred from the particular structure it belongs to. In other words, entailment is only from elements to compound, not vice versa. This is the very essence of reductionism. For example, physics can completely explain biology but no new physical law can be obtained by the study of biology. Strictly speaking materialism and reductionism do not coincide nor implicate each other, but, as a matter of fact, the reductionistic paradigm

¹¹ Roger Penrose, *The road to reality. A complete guide to the laws of the Universe*. Knopf, New York, 2005, pp.782-785.

¹² Albert Einstein, Boris Podolsky, Nathan Rosen, in *Phys. Rev.* 47, 1935, p.777.

¹³ John S. Bell, *On the Einstein-Podolsky-Rosen paradox*, in *Physics* 1, 1964, p.195.

¹⁴ Alain Aspect, Philippe Grangier, Gérard Roger, *Experimental realization of Einstein-Podolsky-Rosen-Bohm Gedanken Experiment*, in *Phys. Rev. Lett.* 49, 1982. p.91.

is fully compatible with a materialistic worldview and, on the other hand, an important point as denial of finalism can be hardly accommodated into a non-reductionistic perspective. Moreover, if we want to adopt a description of reality which is both materialistic and non-reductionistic, the character of physical laws must dramatically change with respect to what we have outlined above.

3.1.2 *The concept of God*

Within a perspective which denies any form of finalism, the appearance in the universe of a being capable of conscious acts and immaterial – we may say *spiritual* – operations is merely a fortuitous event (even life itself is an outcome of pure chance). After the simplest living organism has been assembled by randomly gathering of organic matter, increasing complexity arises from a blind mechanism of mutation-selection, according to Darwinian theory of evolution. The combined effect of chance and necessity¹⁵ is all a materialistic view needs to explain the emergence of unprecedented processes in the universe, from the simplest biological functions of the primeval cells to mind. In this view any spiritual fact is merely a manifestation of the activity of a material system (i.e. human brain) hence with no independent reality.

Explicitly opposed to this position is the one of a God who designs things and plans universe's evolution. We notice that such a God is deeply immanent in the nature He rules. He is considered a being of the highest complexity in order to create the complex structures observed in the universe¹⁶ (highly improbable, since usually complex things follow simple ones and not vice versa). Such a conception relies on the basic epistemological assumption of a formal model coherent and complete of physical reality. According to this assumption God's creative action has to proceed within the syntactic rules of the model (we could say on the background of a "fixed geometry"); so God is ontologically subsequent to reality, in

¹⁵ Jaques Monod, *Le Hasard et la Nécessité*, Editions du Seuil, Paris 1973.

¹⁶ Richard Dawkins, *cit.*, IV.

other words He is immanent. We observe that God's improbability follows from this position. In fact an intelligence capable to create complex structures within a formal system must have at least the (algorithmic) complexity of the things it builds. But the more complex an entity is, the lower the probability to find it in early stages of the universe, since it appears later in the evolution of the natural history.

An alternative characterization depicts God as extremely powerful and not bound by the laws of physics¹⁷: an exception to the rules of material world with the capability of intervening on it. Of course, "not bound by the laws of physics" doesn't mean external to physical reality. Indeed, God has to face with physical laws, even if to overcome them; once again we meet a God somehow constrained by the immanence. This is a very important point: the God denied by the atheists lies on the same metaphysical level of the universe He created. Clearly, this idea contains in its very definition an unavoidable contradiction.

3.2 The rationale of atheistic positions

The arguments against the existence of a creative God are based on a simple consideration: scientific and religious pictures of the universe are not compatible and, if we adopt objective criteria to discriminate between them, we are led to accept the materialistic one. The statement that science and religion mutually exclude is rather strong indeed, but it is consequent with the concept of God outlined in previous section. In fact, a God who directly operates in a universe which He belongs to, leaves observable traces of its actions; these manifest themselves as phenomena inexplicable by physical laws, so that an unambiguous verification is in principle possible.

The search for evidence of divine handiwork in the universe follows three ways¹⁸: first there are miracles; it is obvious that a direct manifestation of God would require no further speculative work. Second: if the materialistic world's description were definitively incomplete, God would be the

¹⁷ Sean M. Carroll, *cit.*

¹⁸*Ibidem.*

necessary hypothesis to fill the epistemological gaps. Finally, God could be a simpler and appealing alternative to a materialistic explanation of the observed patterns in the physical reality unconvincing for its complicated character.

3.2.1 No need of a "God of the gaps"

Now, miracles are excluded since they have not a sound, scientific evidence. As far as the possibility of a lack of explication capability inherent in materialistic description of nature is concerned, there are two ways in which this could happen: if there were classes of phenomena not explicable into the framework of any scientific theory, if the problem of universe's boundary conditions could not be solved without postulate an external intervention.

About the first eventuality materialists notice that science has never stopped since the times of Galileo, so there is no reason to doubt that also the problems still open will be solved in the future; this is true – they say – for all natural sciences, especially physics. But what about the origin of matter, energy, information, space, time... in a word of the universe as a whole? The materialistic answer refers to several models that in modern cosmology explain the occurrence of the Big Bang. Since the inflationary universe theory¹⁹ other proposals have been formulated to overcome the unpleasant feature of a Big Bang arbitrarily posed. In the new inflationary model bubbles of matter and energy are endlessly rising and expanding in a false-vacuum sea²⁰, but also other models assume an eternally existing universe. Recently, a model has been proposed²¹ according to which a couple of twin three-dimensional universes oscillate forever along a fourth dimension; at each collision – once a trillion years – a new Big Bang occurs. There are also theories asserting that the Big Bang is actually non-

¹⁹ Alan H. Guth, *The Inflationary Universe. The Quest for a New Theory of Cosmic Origins*, Basic Books, New York, 1997.

²⁰ Andrei D. Linde, *A New Inflationary Universe Scenario: A Possible Solution of the Horizon, Flatness, Homogeneity, Isotropy and Primordial Monopole Problems*, in *Physics Letters* 108B, 1982, pp.389-392.

²¹ Paul J. Steinhardt, Neil Turok, *Endless Universe. Beyond the Big Bang*, Doubleday, New York, 2007.

singular²² because, nearby the origin, space-time completely changes its features, being more similar to the pole of a sphere rather than the edge of a segment. Finally, it is possible even to conceive a universe coming literally from nothing²³, the process being based on the tunnel effect from a previously existing universe whose radius is set to zero. None of these models requires the “external” divine intervention to set up boundary conditions of the Big Bang.

3.2.2 No need of a “God simplifier”

Let’s now turn to the possibility that God hypothesis represents a convincing explanation for features observed in natural phenomena otherwise obscure and convoluted. This kind of intervention is commonly named “design”, i.e. a plan in the mind of God realized in the nature by means of His omnipotence. A typical example is given by the living organisms, so complex to suggest a direct divine action; nevertheless – assert materialists – after Darwin life is completely explained in terms of random events guided by evolutionary pressure. Moreover, this is true not only for life, but every complex phenomenon in nature can be explained in terms of fundamental (i.e. low-level) physical laws and proper boundary conditions.

Now, these fundamental laws rest on an underlying structure of particle and fields that seems to be to a certain extent contingent, in the sense that other different structures are logically possible as well. Considering this fact a question is mandatory: why just this setup of elementary particles and forces and no other? Is it only the result of a random selection in a huge number of equivalent possibilities? According to the strong version of the anthropic principle²⁴ the fundamental constants are highly fine-tuned so that the stability of heavy nuclei, the existence of complex molecular structures, the

²² James B. Hartle, Stephen W. Hawking, *Wave Function of the Universe*, in *Physical Review D* 28, 1983, pp.2960-2975.

²³ Alexander Vilenkin, *Creation of Universes form Nothing*, in *Physics Letters* 117B, 1982, pp.25-28.

²⁴ John D. Barrow, Frank J. Tipler, *The anthropic cosmological principle*, Claredon Press, Oxford, 1986.

emergence of life and, eventually, the presence of man in the universe are allowed. In fact, if some constant would be even slightly different from its actual value the universe were completely different, e.g. with no other atoms than hydrogen. Clearly, in such an universe life (and hence man) were not possible at all. Some people take these considerations as the evidence of an intelligent design guiding universe's evolution since its very beginning.

The materialistic answer is that we can actually know almost nothing about a universe different from the one we live in, for physics is an inductive science and (by definition) no observation can be made in a universe that exists only as a hypothetical model. Indeed, we cannot actually know what kind of phenomena could happen in a totally different universe, nor if intelligent life would be also possible in other manners from the carbon-based one. Moreover, there is no strict evidence in favour of a single universe; as we have seen in the previous section, some cosmological models take into account a set of universes – i.e. a *multiverse*; if this were the case the majority of them could be unsuitable for life, but we live (and make observations) in one of the few having by pure chance proper physical laws to allow our presence.

3.2.3 *The needless God*

From all the above considerations no evidence comes out against the existence of God, but it is somehow ascertained that it is an unnecessary hypothesis since the whole universe, from quarks to man, can be completely explained without divine intervention. Now, one is free to add God to the set of the hypotheses, but there is no reason to do it, because a complete understanding of the reality without such hypothesis is – in principle – within man's reach. It is a tenet of scientific reasoning that, between competing theories, the one with a minimum of hypotheses must be preferred²⁵; therefore theistic worldviews should be rejected as unreasonable and unnecessarily complicated.

²⁵ This principle constitutes the celebrated "Occam's razor", stated by the English Franciscan friar and scholastic philosopher William of Ockham in early 14th century: *frustra fit per plura quod fieri potest per pauciora*.

4. What's wrong with materialism?

After we have discussed the main arguments against theistic worldview, let's turn to consider the reply to them by the opposite side. We begin with the responses to the issues addressed in section 3.2, but the criticism is wider, investing materialistic conception in its very foundations, especially the epistemological ones.

4.1 "Sed contra" to atheistic arguments

As we have seen above, there are three possible ways of divine manifestation taken into account by materialists and none of them seems to actually occur. If one goes thoroughly the argumentations adduced to support the thesis, some misconceptions can be found. In some cases the conclusions to be drawn are somehow hidden in the premises; otherwise, assumptions not fully justified by the actual stage of scientific development are taken as grounds for subsequent entailments. In brief, there are three orders of considerations to be made: miraculous events are excluded a priori, so no discussion at all is possible about them; the causation realized by God is of different kind with respect to the physical one since the latter concerns the way things are and the former their existence (a world without a transcendental level is not simpler, it is simply self-contradictory); the study of complex systems shows how unsatisfactory are some epistemological tenets of materialism. Let's expand in some detail these arguments.

4.1.1 Do miracles happen?

The question is very awkward, so we do not try any answer. We only notice that even if a miracle really occurred, a materialistic scientist could never recognize it since the possibility of events falling out from the domain of physical laws is excluded by the epistemological bases of his worldview. In fact, as we have seen in section 3.1.1, materialism assumes the existence of a formal model for the whole reality. Since such a model must be complete and coherent, no event can escape from it. When some inexplicable fact is reported, materialist's reaction is to consider it as a

deception, or an usual phenomenon not well understood, or the manifestation of some physical law not yet discovered. A miracle apt to convince an atheist scientist should be replicable in a laboratory under the monitoring of a proper technical equipment. Obviously, this is not what is commonly intended by the word “miracle”.

By a logical point of view, the thesis to be demonstrated is tacitly assumed in the premises, so that it is impossible for whatever event to be classified as miraculous, even if it would be really a miracle. Materialism shows this attitude not only towards phenomena with a religious character, but also in the consideration of all those areas of knowledge not coming from Newtonian science. In particular this is true for medicine. In this field all the approaches based on a different anthropology are judged according to the standards of orthodox medicine and therefore rejected. The positive results claimed by many people adopting alternative medicine are simply interpreted as placebo effect, while “true” healing is only the one obtained by drugs (a poorly objective attitude indeed, since “the fact” is the same in both cases).

4.1.2 Self-sufficiency of the system of physical laws

The faith in a science that – soon or later – will dominate all phenomena is somehow unjustified, especially if we consider that in the last few decades theoretical physics has known an unprecedented stasis²⁶. Perhaps tomorrow natural sciences will explain all the observed phenomena, but even if this is the case a major problem remains: where do physical laws come from? This is a fundamental point in our discussion: a transcendental level of reality is needed not to fill some gaps in actual understanding of material universe, but to justify the system of physical laws as a whole.

The entire universe could also have came out by tunnel effect from nothing as in Vilenkin’s theory²⁷, but why a law holds which allow tunnel effect from nothing? Are natural laws entailed by some form of logical necessity? If this were the

²⁶ Lee Smolin, *The Trouble with Physics*, Mariner Books Houghton Mifflin Company, Boston – New York, 2007.

²⁷ Alexander VILENKIN, *cit.*

case, physics would be a deductive science, but it is commonly accepted nowadays that a priori synthetic judgements do not exist and that nothing about the world can be deduced without any observational reference. Moreover, Gödel's incompleteness theorem indicates that a formal system cannot be self-referential, but needs external foundations; now, if – as asserted by materialists – a formal model of the whole universe is possible and outside the universe nothing exists, how can be satisfied the requirements of Gödel's theorem?

The problem about the origin of physical laws is central in our discussion. The logical possibility of a process doesn't imply automatically its concrete realization, unless proper conditions are given (e.g.: a CO₂ molecule has the possibility of emitting a 9.4 μm photon, but the emission does not occur if the molecule has not been excited before from its ground state to a certain upper energy level), so we may ask which are the possibility conditions of a process responsible of appearance of energy and information from nothing. Since the standard model of elementary particles has symmetry as a basic ingredient, the problem about the ontology of the universe is how an empty geometry comes out from the absolute nothing. But thinking of the absolute nothing as having some structure is contradictory, nor is conceivable a random process *ex nihilo*, because, if there are no agents, no evolution at all (random or not) is possible.

Physical laws do not rise on a background of fixed geometry (i.e. with symmetries already given): paradoxically, this would be indeed equivalent to a rough theistic assert (where do symmetries come from?...). Instead, in a huge number of logical possibilities some processes acquire existence due to a principle which must be external to the system of physical laws, for it is by them presupposed. In other words, if we really want physical laws to come out from the absolute nothing, a sort of *ontological instability* must be assumed, whose origin is to be found outside the system of laws itself (it is conceivable also a situation in which different sets of physical laws give rise to unconnected "bubbles" of reality). The question is not about a God who arbitrarily chooses to provide a set of potential processes with existence,

but how is it possible for a purely potential process to gain existence if nothing is previously present.

Nor this point can be overcome by assuming an eternally existing universe. In fact time, space and the physical reality arise together. Space-time relations without beings connected by them (as in Newtonian conception²⁸) simply make no sense: this is the essence of operationalism²⁹, a position commonly accepted in modern physics. As a consequence, the need of a causation for the universe's existence cannot be cancelled by removing the kick off event, since the cause required is earlier not in a chronological sense, but in an ontological one. Even if we restrict ourselves to the physical compass, the hypothesis of an eternally existing universe is useless. In fact, a forward infinite series has the first term, the second one, and so on, but not the last; similarly, a backward infinite series has the last term while not the first one. But, if the terms of the series are causally connected events, without the first no second one occurs and so on; thus the whole series cannot exist. Once again we meet a fundamental feature of physical causality: it cannot justify itself, so that a different order of causation is necessary.

In the *Critique of Pure Reason*, Immanuel Kant excludes the possibility of any rational path to the transcendental level of reality; in particular, since we know causality only in material compass, it is improper to extend it beyond that limit. This is a valid argument indeed, but it is also true that the patterns we observe in the universe belong to physical realm, and everything in this realm must come from something else. The alternative to a transcendent creative principle is to admit a province of not-be from which something real comes out (contrary to all scientific and philosophical doctrines since the time of Parmenides): indeed a hypothesis much less convincing than the one of a creative God.

²⁸ cfr. Isaac Newton, *Principia*, I.

²⁹ Percy W. Bridgman, *The Logic of Modern Physics*, Macmillan, New York, 1927.

4.1.3 About finalism

As far as the argument against a “God simplifier” is concerned, it seems quite reasonable that no supernatural intervention is required to explain complex phenomena as life. During the last centuries natural sciences (especially biology) have collected a large number of evidences against naive forms of finalism and Darwinism, supported by genetics, resulted very effective to explain the features of living things. But is this sufficient to exclude any form of finalism? In particular there are two critical points with the materialistic position: it is assumed that complex phenomena can completely be explained by means of low-level laws (the standard model of elementary particles or even something more fundamental, as string theory); Darwinism is considered a comprehensive theory of life – and not only of life³⁰ – which can solve also the problem of the origins, if one assumes a random fluctuation at the root of the process³¹.

The two issues are closely related. It has been estimated³² that in Earth’s history some 10^{51} trials to random assemble a living thing from primordial soup occurred. The probability to obtain by pure chance the enzymatic network of a simple bacterium are instead of the order of $10^{40.000}$: it is not a highly improbable event, it is simply impossible. Are we led to admit an intervention out of the physical laws in order to explain the origin of life? Not necessarily. The American biologist Stuart Kauffman has argued that – under proper conditions – physical systems spontaneously evolve towards states of higher and higher complexity³³; if this is the case a tendency in the direction of life and, within biosphere, of “human” life (i.e. of enough complexity to support spiritual activities) is deeply inscribed in Nature’s laws³⁴. This is a form of “bottom-up”

³⁰ Richard Dawkins, *cit.*, IV.

³¹ Jaques Monod, *cit.*

³² Robert Shapiro, *Origins. A Skeptic's Guide to the Creation of Life on Earth*. Summit, New York, 1986.

³³ Stuart Kaufman, *Investigations*, Oxford University Press, New York – Oxford, 2000.

³⁴ Stuart Kauffman, *At home in the universe*, Oxford University Press, New York – Oxford, 1995.

finalism quite different from the “top-down” more radical approach of creationism.

We make the hypothesis of a spontaneous tendency of physical systems toward states of increasing complexity, but natural tendencies are ruled by proper physical laws; so, which kind of laws are involved in this case? Probably, there is a whole province of physics still largely unexplored regarding the laws of complexity. It was Schrödinger, in a lectures series held at Trinity College in 1943³⁵, who first advanced the hypothesis that biological phenomena are ruled by new laws. Schrödinger’s proposal was quite brave, since it contradicts one of the major dogmas of reductionism: a composed system is completely explicable in terms of its constituent parts, whose behaviour does not depend upon the structure they belong to (in other words biology can be reduced to physics, but no new physical law can be discovered by the study of living organisms³⁶).

Within this perspective, there is no contradiction between finalism and evolution; complexity laws and natural selection are cooperative paradigms, both necessary to explain origin and development of life.

4.2 Criticism to materialistic worldview

In addition to the above considerations, there are deeper reasons to reject atheistic arguments, moving from the recognition of several incongruities in materialistic worldview. There are (at least) two critical points in materialism: the first is the intrinsic weakness of its epistemological bases (in particular the assumptions about reductionism and computability) which affects any conclusion drawn within this paradigm; the second is more specific to the issue we are discussing and consists in assuming a God’s idea quite different from the one of the main mystic and religious traditions (in a way that the thesis to be demonstrated is

³⁵ The lectures were published next year: Erwin Schrödinger, *What is Life? The Physical Aspect of the Living Cell*, Cambridge University Press, Cambridge, 1944.

³⁶ For a critical analysis of the reductionistic paradigm see Robert Rosen, *Essays on Life itself*, Columbia University Press, New York – Chichester, West Sussex, 2000.

implicitly contained in the premises, so that the argument has no value).

4.2.1 Epistemology

In the materialistic perspective it is assumed that it is possible to model the world as a formal system which is coherent (it contains no ambiguities or contradictions) and complete (it takes into account and explains all phenomena) at the same time. Apart from the severe limitations imposed by Gödel incompleteness theorem, there is a major difficulty due to the assumption that nothing exists outside the universe described by the model itself. Moreover, the effectiveness of the model implies that it is also computable (algorithmically computable, according to Church thesis), at least in principle. In such a perspective meanings come from the model itself (since they cannot come from outside) or, in other words, semantics is generated by pure syntactic rules. This is a framework into which *impredicativities* are not allowed; a feature is considered impredicative if cannot be generated by applying rules from a finite set of syntactic productions, so that it has to be defined in terms of the totality it belongs to. Clearly, a model containing such features is not computable, in the Church thesis sense. Now, impredicativities are not exceptions in the universe since they represent complex systems (life is a major example); rather, simple systems having only computable models are rare and peculiar³⁷. Of course, these considerations do not rule a model for the entire universe out, but they suggest severe constraints on computability, fractionability and completeness of such a model, as well as on its reductionistic character. The universal model supposed by materialists, if exists, should have quite different features from the ones imagined by them.

What in a formal model is logical implication, in the physical system related to it by a suitable interpretation is causal entailment. Here we meet a fundamental question: are causal relations real or not? Empiricism (on which materialism is largely based) has a clear answer: no, they aren't, since the

³⁷ *Ibidem*.

observer has a direct experience of the cause-effect succession, but never of the causal relation itself. After the discovery of the lack of determinism at microscopic level, new arguments have been developed to support Hume's position. In particular, since we cannot predict the evolution of a quantum system but only its probability to jump into a given state after a measurement process, macroscopic causality is considered a mere consequence of the law of large numbers, while atomic scale events are ruled by acausal laws³⁸.

The argument seems to be not very convincing, in particular we notice in it the equivalence between "causal" and "computable", an equivalence which ceases if the model contains impredicativities. Moreover, if we adopt a wider concept of causality (as the original one developed by Aristotle from which the modern one has derived) we must take into account a number of factors: the matter of the initial state of the process, the agent which triggers the process, the structure of the final state. Now, even at the quantum level, these factors are ever present and well defined, so that it seems quite inappropriate to identify determinism with causality. In other terms, if we have for example an atom in an upper energetic level, it is certainly true that it decays into the fundamental state in an unpredictable way, but the initial state of the system is exactly the one required by the process to happen, vacuum fluctuations of electromagnetic field couple with the atom as the photon is emitted, after the process energy and the other quantum numbers of atom and photon are fully consistent with system's initial state.

4.2.2 *The concept of God*

As noticed in section 3.1.2, the target of materialistic criticism is a Divinity who have very poor transcendence, quite similar to the demigods of ancient cults. Any possibility for such an immanent God to be the world's creator is logically ruled out (how can He have created the same reality which He belongs to?): in this sense atheistic arguments are fully

³⁸ This position about causality is clearly exposed in: John Von Neumann, *Mathematical Foundations of Quantum Mechanics*, Princeton University Press, Princeton, 1955, pp.326-327.

agreeable. But if we take into account major religious and mystic traditions, both eastern and western, we see that the common character of God is just transcendence.

In the Old Testament, God say to Moses about himself³⁹: “I am who I am”, that means pure be, without determinations. In fact, everything in the universe exists in a definite way, while God is infinite in the two senses: negative as absence of limitations (this is the root of transcendence, since nothing exists if not finite and somehow limited), positive as absolute and unlimited richness (this is related to His creative power).

Islam forbids any representation of God because no finite attribute is suitable for Him; in the Buddhist *Nirvana* the union of soul with Divinity is a dissolution in nothing. Christianity considers transcendence as one of the most important attributes of God, even if His word (or *logos*) inhabited space and time in the person of Jesus Christ. According to the doctrine of St. Thomas Aquinas, created beings receive their existence from something else; God instead is necessary existence, depending upon nothing else. No finite attribute is associated with Him, only a pure and unlimited existence, upon which finite existence of material reality depends.

In great mystics, of both eastern and western traditions, the aspect of divine transcendence is even more emphasized. Meister Eckhart for example, who lived in Germany between 13th and 14th century, wrote in a sermon⁴⁰ about St. Paul’s conversion that, when he met Jesus on the road to Damascus and became temporarily blind, he raised from the ground and with his open eyes saw nothing, and this nothing was God. The concept is clear: God is totally different from any object accessible to our senses or imagination because His reality is on another plane, therefore it is not incorrect to characterize Him as “pure nothing”. St. John of the Cross, who lived in Spain about two centuries after Meister Eckhart, described the “soul’s night” as the obliteration of all mind’s faculties to join God in an absolute vacuum; similar concepts are also

³⁹ *Exodus*, III, 14.

⁴⁰ *Surrexit autem Saulus de terra apertisque oculis nihil videbat.*

expressed in the Bhagavad Gita, the most celebrated sacred text of Hindu religion.

In conclusion, one cannot be in disagreement with atheists when they deny the existence of a “superhero God” who intervenes directly in material reality, but this is a quite different God from the one which many believers all over the world have in mind.

5. The correct relation between religion and science

We are finally to the question in the title of the present paper: is science incompatible with any religious belief? Of course, the answer depends on what is meant by “science” and “God”, but, according to the considerations of above sections, it must be yes if we adopt reasonable definitions for both the terms.

5.1 Scientific point of view on the universe

The basic assumptions of materialistic worldview seem to be quite critical if we consider a number of facts coming especially from the science of complex systems. In particular it is difficult to accept the postulate of a complete formal model for the universe and a quest of fundamental physical laws that points only in the reductionistic direction. Obviously, the refusal of these assumptions (and the choice of alternative directions for the basic research⁴¹) neither exclude the possibility of build mathematical models for the reality as a whole nor directly forces to accept the existence of God, but, as a matter of fact, if one abandons them the atheistic arguments against a religious worldview loose most of their strength.

In a wider concept of science “explication” and “computation” do not coincide; we can however understand impredicativities within an incomplete (in Gödel’s sense) model whose completion is to be sought outside the compass of formal models. According to such a position there are forms of knowledge other than positive science, equally valid but with different methods from the ones of Galilean physics. It is to be stressed that these alternative forms of knowledge are

⁴¹ See, for example, Robert Laughlin, *A Different Universe. Reinventing Physics from the bottom Down*, Basic Books, New York, 2005.

nothing of esoteric and that model's limited computability or incompleteness do not require any supernatural or divine direct intervention to make fully consistent the system of physical laws.

5.2 God's role

The non-reductionistic vision of science and nature that emerges from the consideration of complex phenomena requires a new consideration of the ontological problem (of no importance within the traditional paradigm into which existence is a consequence of logical possibility), so that a discussion is possible about God as the first cause of the whole universe's existence. Clearly, we're talking about a God completely separated from physical reality, absolutely transcendent. In fact, if God had some immanent feature, He should possess at the creation's act some aspects ontologically subsequent, so He would be self-contradictory.

A transcendent God is not accessible by scientific inquiry; about His existence we can only say that a level of reality beyond physical universe is required to avoid contradiction in any cosmogony (past, present or future). Divine aspects cannot be deduced, only revealed by God himself, but to accept the possibility of a revelation at all and, in that case, which religion to embrace, is a matter of personal choice.

5.2.1 Where atheists are right

The deductions developed by the materialistic side against God's existence have paradoxically an important positive aspect for believers: they show the inconsistency of immanent conceptions of divinity. The arguments against a "God of the gaps" or a "God simplifier" are sound and correct and – even if miracles cannot be a priori excluded – they tell us that there is no need of a divine epistemological patch for the system of natural laws.

This is a concept never enough emphasized. In fact one sees often unacceptable blends of spiritual aspects and material ones that make religion quite similar to superstition or something even worse. Maybe it sounds strange, but believers should take carefully into account materialistic

criticism; it can help them in the way to a purely transcendent God (which doesn't exclude the possibility of Revelation, rather founds it).

6. Conclusions

According to the materialistic worldview it is possible to model the world as a formal system which is both complete and coherent. Every observable aspect or phenomenon in nature can be fully explained in terms of physical laws expressed in a mathematical language. Even the need of arbitrary posed boundary conditions can be avoided in the framework of cosmological theories in which universe appears as a result of a tunnel effect from nothing or has no space-time boundaries at all. Within this perspective God is a needless hypothesis, if with the term "God" we mean someone (or something) that rules phenomena inexplicable in terms of physical laws or gives an easier interpretation for some of the observed patterns in nature. Moreover, miracles are excluded a priori as a valuable possibility.

There are several critical points with this position. A model of the whole physical reality (yet to be discovered) could hardly be complete and coherent; moreover the study of complex systems indicates that in a large number of phenomena a description based on a reductionistic approach is simply inapplicable: this poses severe restrictions on the computational possibilities of the model itself. Obviously, the recognition of impredicativities doesn't entail a divine action, but it shows the intrinsic weakness of a strictly materialistic worldview.

The target of atheistic arguments is a God quite immanent, a sort of superhero who directly intervenes imposing physical laws and boundary conditions of the universe according to His will. Such a God is very different from the one of the main religious and mystic traditions, who is fully transcendent. Within this perspective the correct question is not "are there phenomena that physical laws are unable to explain?", but rather "what is the origin of physical laws?". In fact logical possibility does not suffice to allow the concrete existence of a process; if this were the case we should consider physics as a deductive science with self-evident premises. In order to avoid

contradiction, a cause for the existence of possible processes (what we have called *ontological instability*) is required and this causal agent is to be found on a plane transcendent with respect to the material reality.

Such a definition of the creative action of God also indicates the framework for a correct relation between religion and science: the possibilities within physical world are completely described by models having no reference to concepts like “God”, “soul” and similar; on the other hand, the existence of the observed patterns cannot be explained without recourse to a transcendent and immaterial level of reality. Finally, we notice how precious for believers the atheistic lesson may be in showing the complete inconsistency of any concept of a God contaminated with elements of immanence.

Bibliography

1. ANTONIO L., *Philosophie du sens commun. Logique aléique de la science et de la foi*, L'Age d'Homme, Lausanne-Paris, 2004.
2. ASPECT A., GRANGIER P., ROGER G., *Experimental realization of Einstein-Podolsky-Rosen-Bohm Gedanken Experiment*, Phys. Rev. Lett. 49, 91, 1982.
3. BARROW J.D., TIPLER F.J., *The anthropic cosmological principle*, Claredon Press, Oxford, 1986.
4. BELL J.S., *On the Einstein-Podolsky-Rosen paradox*, Physics 1, 195, 1964.
5. BRIDGMAN P.W., *The Logic of Modern Physics*, Macmillan, New York, 1927.
6. CARROLL S.M., *Why (Almost All) Cosmologists are Atheists*, prepared for God and Physical Cosmology: Russian-Anglo American Conference on Cosmolgy and Theology, Notre Dame, January/February 2003.
7. DAWKINS R., *The God Delusion*, Houghton Mifflin, Boston, 2006.
8. EINSTEIN A., PODOLSKY B., ROSEN N., Phys. Rev. 47, 777, 1935.
9. GUTH A.H., *The Inflationary Universe. The Quest for a New Theory of Cosmic Origins*, Basic Books, New York, 1997.
10. HARTLE J.B., HAWKING S.W., *Wave Function of the Universe*, Physical Review D 28, 2960-2975, 1983.

11. KAUFFMAN S., *At home in the universe*, Oxford University Press, New York, Oxford, 1995.

12. KAUFFMAN S., *Investigations*, Oxford University Press, New York, Oxford, 2000.

13. LAUGHLIN R., *A Different Universe. Reinventing Physics from the bottom Down*, Basic Books, New York 2005.

14. LINDE A.D., *A New Inflationary Universe Scenario: A Possible Solution of the Horizon, Flatness, Homogeneity, Isotropy and Primordial Monopole Problems*, Physics Letters 108B, 389-392, 1982.

15. MONOD J., *Le Hasard et la Nécessité*, Editions du Seuil, Paris, 1973.

16. PENROSE R., *The road to reality. A complete guide to the laws of the Universe*, Knopf, New York, 2005.

17. ROSEN R., *Essays on Life itself*, Columbia University Press, New York, Chichester, West Sussex, 2000.

18. SCHRÖDINGER E., *What is Life? The Physical Aspect of the Living Cell*, Cambridge University Press, Cambridge, 1944.

19. SHAPIRO R., *Origins. A Skeptic's Guide to the Creation of Life on Earth*, Summit, New York, 1986.

20. SMOLIN L., *The Trouble with Physics*, Mariner Books Houghton Mifflin Company, Boston, New York, 2007.

21. STEINHARDT P.J., Turok N., *Endless Universe. Beyond the Big Bang*, Doubleday, New York, 2007.

22. VILENKIN A., *Creation of Universes form Nothing*, Physics Letters 117B, 25-28, 1982.

23. VON NEUMANN J., *Mathematical Foundations of Quantum Mechanics*, Princeton University Press, Princeton, 326-327, 1955.