

[Omega Point \(Tipler\)](#)

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(June 2008)

The **Omega Point** is a term used by Tulane University professor of mathematics and physics Frank J. Tipler to describe what he maintains is a necessary cosmological state in the far future of the universe. According to his **Omega Point Theory**, as the universe comes to an end at a singularity in a particular form of the Big Crunch, the computational capacity of the universe is capable of increasing at a sufficient rate that is accelerating exponentially faster than the time running out. In principle, a simulation run on this universal computer can thus continue forever in its own terms, even though the universe lasts only a finite amount of proper time. Tipler states this theory requires that the current known laws of physics are true descriptions of reality, and it requires there be intelligent civilizations in existence at the appropriate time to exploit the computational capacity of such an environment.

Tipler identifies this final singularity and its state of infinite information capacity with God. The implication of this theory for present-day humans is that this ultimate cosmic computer will be able to run computer simulations of all intelligent life that has ever lived, by recreating simulations of all possible quantum brain states within the master simulation. This would manifest as a simulated reality. From the perspective of the recreated inhabitant, the states near the Omega Point would represent their resurrection in an infinite-duration afterlife, which could take any imaginable form due to its virtual nature.

Assuming that achieving the Omega Point is physically possible, Tipler says this would be accomplished by “downloaded” human consciousness in tiny quantum computers that could exponentially explore space, many times faster than biological human beings. Tipler argues that the incredible expense of keeping humans alive in space implies that flesh-and-blood humans will never personally travel to other stars. Instead, highly efficient uploads of human minds (“mind children” as Tipler calls them, they being the mental uploads of our descendants; the term is perhaps from a 1988 book of the same name by Hans Moravec) and artificial intelligences will spread civilization throughout space. This should start as early as 2100. Small spaceships under constant heavy acceleration could reach nearby stars in less than a decade. In one million years, these intelligent von Neumann probes would have completely consumed the Milky Way galaxy. In 100 million years, the Virgo Supercluster would be colonized. From that point on, the entire visible universe would be engulfed by these “mind children” as it approaches the point of maximum expansion.

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History of the Omega Point Theory

Prof. Tipler has published his Omega Point Theory in a number of peer-reviewed scientific journals since 1986. The first book wherein the Omega Point Theory was described was 1986's *The Anthropic Cosmological Principle*, written by astrophysicist John D. Barrow and Tipler. The first book solely concentrating on the Omega Point Theory was Tipler's *The Physics of Immortality* in 1994.

Physicist David Deutsch in his 1997 book *The Fabric of Reality* defends the physics of Tipler's Omega Point Theory in Chapter 14: "The Ends of the Universe" (of which chapter concentrates mainly on the Omega Point Theory):

I believe that the omega-point theory deserves to become the prevailing theory of the future of spacetime until and unless it is experimentally (or otherwise) refuted. (Experimental refutation is possible because the existence of an omega point in our future places certain constraints on the condition of the universe today.)

Deutsch later comments within a concluding paragraph of the same chapter regarding the synthesis of his "four strands" of fundamental reality, which includes the strengthened version of mathematician Alan Turing's theory of universal computation in the form of the Omega Point Theory:

It seems to me that at the current state of our scientific knowledge, this is the 'natural' view to hold. It is the conservative view, the one that does not propose any startling change in our best fundamental explanations. Therefore it ought to be the prevailing view, the one against which proposed innovations are judged. That is the role I am advocating for it. I am not hoping to create a new orthodoxy; far from it. As I have said, I think it is time to move on. But we can move to better theories only if we take our best existing theories seriously, as explanations of the world.

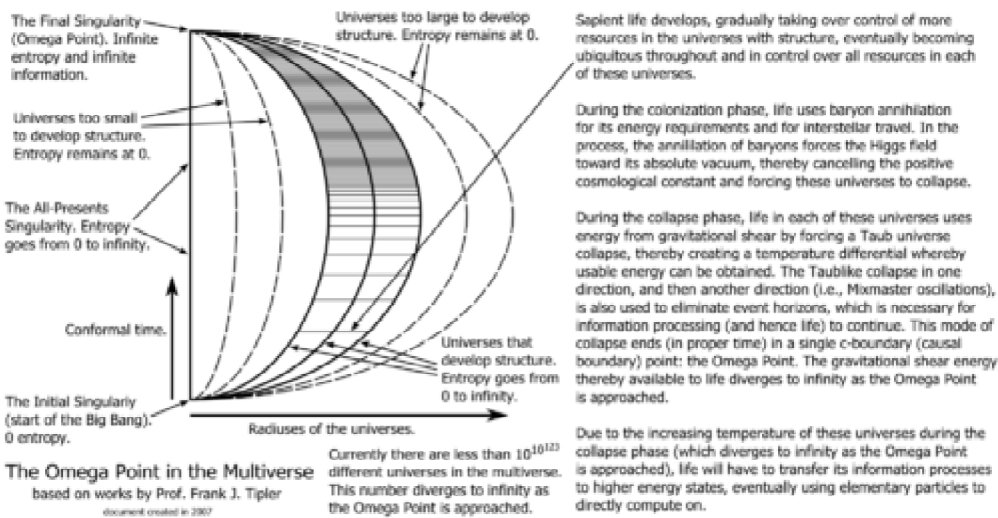
In 2007 Prof. Tipler's book *The Physics of Christianity* was published, which analyzes the Omega Point Theory's pertinence to Christian theology. In the book Tipler identifies the Omega Point as being the Judeo-Christian God, particularly as described by Christian theological tradition, e.g., that the Omega Point cosmology when formulated in multiversal terms (of which multiverse conception isn't necessary for the physics upon which the Omega Point itself is based) is fundamentally triune in its structure: the Final Singularity (i.e., the Omega Point), the All-Presents Singularity (which Tipler states exists at all times at the edge of the multiverse), and the Initial Singularity (i.e., the beginning of the Big Bang), which Tipler identifies with the Father, the Son and the Holy Spirit, respectively (successively, the First, Second and Third Persons of the Trinity). In this book Tipler also analyzes how Jesus Christ could have performed the miracles attributed to him in the New Testament without violating any known laws of physics, even if one were to assume that we currently don't exist on a level of implementation in a computer simulation (in the case that we did, then according to Tipler such miracles would be trivially easy to perform for the society which was running the simulation, even though it would seem amazing from our perspective).


The Physics of Christianity shows a change from Prof. Tipler's earlier position within *The Physics of Immortality* regarding theism and Christianity. In the opening paragraph of Chapter XII: "The Omega Point

and Christianity” of *The Physics of Immortality*, Tipler wrote the following:

To emphasize the scientific nature of the Omega Point Theory, let me state here that I am at present forced to consider myself an atheist, in the literal sense that I am not a theist. (*A-theist* means “not theist.”) I do not yet even believe in the Omega Point. The Omega Point Theory is a viable scientific theory of the future of the physical universe, but the only evidence in its favor at the moment is theoretical beauty, for there is as yet no confirming experimental evidence for it. Thus scientifically one is not compelled to accept it at the time of my writing these words. So I do not. Flew, among others, has in my opinion made a convincing case for the presumption of atheism. If the Omega Point Theory and all possible variations of it are disconfirmed, then I think atheism in the sense of Flew, Hume, Russell, and the other self-described atheists is the only rational alternative. But of course I also think the Omega Point Theory has a very good chance of being right, otherwise I would never have troubled to write this book. If the Omega Point Theory is confirmed, I shall then consider myself a theist.

Tipler now regards himself as a theist due to what he states have been advancements in his Omega Point Theory which occurred after the publication of *The Physics of Immortality*. Namely, Tipler now says the known laws of physics—specifically, quantum mechanics, general relativity, the second law of thermodynamics, and the Standard Model of particle physics—require the existence of the Omega Point singularity in order to avoid their violation; whereas in *The Physics of Immortality* Tipler investigated what would be necessary from the postulate that life continues forever while still keeping the analysis confined to the known laws of physics. Tipler states that these physical laws have been repeatedly confirmed by every experiment to date. According to Tipler, this constitutes a massive body of empirical evidence for the Omega Point Theory’s correctness. And as indicated above, Tipler also now considers himself a Christian due to his identification of the Omega Point with the God of Christian theological tradition.



 A diagram of the multiverse formulation of the Omega Point.

Outline of the physics of the Omega Point Theory

According to Prof. Tipler from a 2005 paper in the journal *Reports on Progress in Physics*, he outlines the

following reasons why he maintains the universe must end in the Omega Point in order for the known laws of physics (i.e., unitarity, the second law of thermodynamics, the Bekenstein bound, and general relativity) to be mutually consistent at all times:

Astrophysical black holes almost certainly exist, but Hawking and Wald have shown that if black holes are allowed to exist for unlimited proper time, then they will completely evaporate, and unitarity will be violated. Thus, unitarity requires that the universe must cease to exist after finite proper time, which implies that the universe has spatial topology S^3 . The Second Law of Thermodynamics says the amount of entropy in the universe cannot decrease, but Ellis and Coule and I have shown that the amount of entropy already in the CMBR will eventually contradict the Bekenstein Bound near the final singularity unless there are no event horizons, since in the presence of horizons the Bekenstein Bound implies the universal entropy $S \leq \text{constant} \times R^2$, where R is the radius of the universe, and general relativity requires $R \rightarrow 0$ at the final singularity. If there are no horizons then the (shear) energy density can grow as R^{-6} which means that the total available energy grows as $(R^{-6}) R^3 \sim R^{-3}$, and so the Bekenstein Bound yields $E R \sim (R^{-3}) R \sim R^{-2}$ which diverges as R^{-2} as $R \rightarrow 0$ at the final singularity. The absence of event horizons by definition means that the universe's future c-boundary is a single point, call it the *Omega Point*. MacCallum has shown that an S^3 closed universe with a single point future c-boundary is of measure zero in initial data space. Barrow, Cornish and Levin and Motter have shown that the evolution of an S^3 closed universe into its final singularity is chaotic. Yorke *et al* have shown that a chaotic physical system is likely to evolve into a measure zero state if and only if its control parameters are intelligently manipulated. Thus life (\equiv intelligent computers) almost certainly must be present *arbitrarily close* to the final singularity in order for the known laws of physics to be mutually consistent at all times. Misner has shown in effect that event horizon elimination requires an infinite number of distinct manipulations, so an infinite amount of information must be processed between now and the final singularity. The amount of information stored at any time diverges to infinity as the Omega Point is approached, since $S \rightarrow +\infty$ there, implying divergence of the complexity of the system that must be understood to be controlled.

Some have pointed out that the current acceleration of the universe's expansion due to the positive cosmological constant would appear to obviate the Omega Point. On this matter Prof. Tipler states (see also references and) that baryon annihilation—which he says would be the ideal form of energy resource and rocket propulsion during the colonization of the universe—will force the Higgs field to its absolute vacuum state, resulting in the universe's collapse:

The SM provides such a mechanism, which I actually discussed in the last section of the Appendix for Scientists in (, p. 515). This mechanism is the creation/destruction of baryon number by electroweak quantum tunneling. (Baryons are the heavy particles made up of quarks. Examples are neutrons and protons.) In my book, I pointed out that this mechanism would be ideal for propelling interstellar spacecraft, but I did not discuss its implications for the Higgs vacuum, a serious oversight on my part. (An oversight which invalidates the second part of my Fifth Prediction on page 149 of .) If the SM is true—ALL experiments conducted to date indicate that it is (e.g. and , last full paragraph on p. 35)—then the net baryon number observed in the universe must have been created in the early universe by this mechanism of electroweak quantum tunneling. If the baryons were so created, then this process necessarily forces the Higgs field to be in a vacuum state that is not its absolute vacuum. But if the baryons in the universe were to be annihilated by this process, say by the action of intelligent life, then this would force the Higgs field toward its absolute vacuum, canceling the positive cosmological constant, stopping the acceleration, and allowing the universe to collapse into the Omega Point. Conversely, if enough

acceleration, and allowing the universe to collapse into the Omega Point. Conversely, if enough baryons are not annihilated by this process, the positive cosmological constant will never be canceled, the universe will expand forever, unitarity will be violated, and the Omega Point will never come into existence. Only if life makes use of this process to annihilate baryons will the Omega Point come into existence.

The Omega Point and the quantum gravity Theory of Everything

In his 2005 paper in the journal *Reports on Progress in Physics*, Prof. Tipler maintains that the correct quantum gravity theory has existed since 1962, first discovered by Richard Feynman in that year, and independently discovered by Steven Weinberg and Bryce DeWitt, among others. But, according to Tipler, because these physicists were looking for equations with a finite number of terms (i.e., derivatives no higher than second order), they abandoned this qualitatively unique quantum gravity theory since in order for it to be consistent it requires an arbitrarily higher number of terms. “They also did not realize that the correct quantum gravity theory is consistent only if a certain set of boundary conditions are imposed ...,” writes Tipler (which includes the initial Big Bang, and the final Omega Point, cosmological singularities). Tipler says that the equations for this theory of quantum gravity are term-by-term finite, but the same mechanism that forces each term in the series to be finite also forces the entire series to be infinite (i.e., infinities that would otherwise occur in spacetime, consequently destabilizing it, are transferred to the cosmological singularities, thereby preventing the universe from immediately collapsing into nonexistence). Tipler writes that “It is a fundamental mathematical fact that this is the best that we can do. ... This is somewhat analogous to Liouville’s theorem in complex analysis, which says that all analytic functions other than constants have singularities either a finite distance from the origin of coordinates or at infinity.”

From the aforesaid *Reports on Progress in Physics* paper, Prof. Tipler elaborates on the mathematics and physics of this issue, in part explained below:

So basic quantum field theory quickly forces upon us the general invariant action

$$S = \int d^4x \sqrt{-g} \left(\Lambda + \frac{1}{8\pi G} R + c_1^2 R^2 + c_1^3 R^3 \dots + c_2^2 R_{\mu\nu} R^{\mu\nu} + \dots + c_1^3 R_{\mu\nu;\alpha} R^{\mu\nu;\alpha} + \dots \right)$$

(3)

This is the qualitatively unique gravitational Lagrangian picked out by quantum mechanics.

Physicists do not like it because (1) it has an infinite number of (renormalizable) constants c_j^i , all of which must be determined by experiment and (2) it will not yield second order differential equations which all physicists know and love. But the countable number of constants are in effect axioms of the theory, and I pointed out in an earlier section that the Löwenheim–Skolem theorem suggests there is no real difference between a theory with a countable number of axioms and a theory with a finite number of axioms. The finite case is just easier for humans to deal with, provided the ‘finite’ number is a small number. Further, as Weinberg has emphasized, this Lagrangian generates a quantum theory of gravity that is just as renormalizable as QED and the SM. Since quantum field theory itself is forcing the Lagrangian (3) on us, I propose that we accept the judgement of quantum mechanics and accept (3) (and the countable number of additional terms involving the non-gravitational fields interacting with the $h_{\mu\nu}$) as the actual Lagrangian of reality. Donoghue and Donoghue and Torma have shown that Lagrangian (3) will not contradict experiment provided the (renormalized) values of the infinite number of new coupling constants

are sufficiently small. ...

One consequence of the above Lagrangian being the true description of quantum gravity, explains Prof. Tipler, would be that so long as one is within spacetime, then one can never obtain a *complete* description of quantum gravity and hence of physics: there will always be infinitely more to learn and discover in the field of physics, including by requiring the use of experiment. He says that physics will be able to become ever-more refined, knowledgeable and precise, but never complete (i.e., within spacetime). Only at the final singularity of the Omega Point (which is not in spacetime) will the full description of physics be obtained, states Tipler.

In the same aforesaid journal article, Prof. Tipler combines the above theory of quantum gravity with an extended Standard Model in order to form what he maintains is the correct Theory of Everything (TOE) describing and unifying all the forces in physics.

Out of 50 articles, Prof. Tipler's said paper was selected as one of 12 for the "Highlights of 2005" accolade as "the very best articles published in *Reports on Progress in Physics* in 2005 . Articles were selected by the Editorial Board for their outstanding reviews of the field. They all received the highest praise from our international referees and a high number of downloads from the journal Website." *Reports on Progress in Physics* is the leading journal of the Institute of Physics (based on its impact factor, according to *Journal Citation Reports*), Britain's main professional body for physicists.

Implications from string theory

If string theory is valid, it would seem to contradict the Omega Point Theory, since the Omega Point Theory requires the existence of a cosmological singularity at the end of time. Whereas, according to string theory, singularities do not actually exist because no material object can be compressed below the Planck length. Prof. Tipler himself argues against the validity of string theory.

See also

- Omega point (Pierre Teilhard de Chardin)
- John D. Barrow
- David Deutsch
 - *The Fabric of Reality*, a book by David Deutsch.
- digital physics
- eschatology
- grand unification theory (GUT)
- quantum gravity
- resurrection of the dead
- simulated reality
- supertask
- teleology
- theory of everything (TOE)
- unified field theory

Physics books dealing with the Omega Point Theory

- Frank J. Tipler, *The Physics of Christianity* (New York: Doubleday, 2007), ISBN 0385514247. Chapter I and excerpt from Chapter II. Chapter I also available here.
- David Deutsch, *The Fabric of Reality: The Science of Parallel Universes—and Its Implications* (London: Allen Lane The Penguin Press, 1997), ISBN 0713990619. Extracts from Chapter 14: “The Ends of the Universe,” with additional comments by Frank J. Tipler; also available here and here.
- Frank J. Tipler, *The Physics of Immortality: Modern Cosmology, God and the Resurrection of the Dead* (New York: Doubleday, 1994), ISBN 0198519494. 56-page excerpt available here.
- John D. Barrow and Frank J. Tipler, Foreword by John A. Wheeler, *The Anthropic Cosmological Principle* (Oxford: Oxford University Press, 1986), ISBN 0198519494. Excerpt from Chapter 1.

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9. ^ *a b c* Frank J. Tipler, *The Physics of Immortality: Modern Cosmology, God and the Resurrection of the Dead* (New York: Doubleday, 1994), ISBN 0198519494.

10. ^ David Deutsch, *The Fabric of Reality: The Science of Parallel Universes—and Its Implications* (London: Allen Lane The Penguin Press, 1997), ISBN 0713990619. Extracts from Chapter 14: “The Ends of the Universe,” with additional comments by Frank J. Tipler; also available here and here.
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