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What the Future Holds for the Universe and Us? Christian Theology in Conversation with Stephen Hawking

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Stephen Hawking used his worldwide fame to warn of several future existential threats to humanity. The pessimism of some of these scenarios was interwoven with a belief in science as savior and an increasing skepticism of the value of religion and belief in God. Yet, alongside the challenge of how the power of science can be used responsibly, there are also challenges that are beyond the power of science. For example, the future futility of the universe due to its acceleration, which is driven by dark energy. The long-term future is a cold and lifeless state. Here, science as savior is unable to provide optimism. Likewise, it challenges religious views of a creation getting increasingly better. This article argues that Christian theology, which takes seriously the bodily resurrection of Jesus and includes the New Testament's understanding of new creation, is a fruitful conversation partner with this scientific picture. In addition, it recognizes science as a transformative gift of God to be used alongside and for God's purposes.

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Introduction

A few years ago, British television's Channel 4 devoted an evening of programming to an "End of the World Night." In contrast to the scientific optimism that has sometimes been used to dream of future utopia or the belief in science as savior that will deliver humanity from global challenges, scientists presented ever more pessimistic scenarios for the future. Naturally occurring or bioengineered viruses, out of control AI seeing humanity as a threat, and weapons of mass destruction being created and controlled by power hungry dictators were all placed alongside an environmental crisis where global warming leads to rising sea levels, food insecurity, and worldwide environmental refugees. And behind it all was the end of the universe itself, in futility.

Those who hold Christian faith will have noted that Channel 4 chose to air this End of the World Night on Holy Saturday, the day between Good Friday and Easter Sunday. It did not seem this was intentional, but for those of Christian faith, perhaps it was noteworthy. For Christians, hope for the world stands between the reality of evil and destruction in the crucifixion and then God's victory of love over death in the resurrection of Jesus. Yet, in the pessimism-fest of the End of the World Night, the discussion was all about science, and even in the midst of such a Christian festival, it was hermetically sealed from any theological considerations.

Part of the reason for this is that Christian theologians have been slow to engage with such specific science, especially to see it in dialogue with the death and resurrection of Jesus. The surprise of this is that in the latter part of the twentieth century, Christian theology saw a renaissance in thinking about the future, which is eschatology. In Hans Urs von Balthasar's (1960, 276) famous dictum, eschatology in the last few decades was working overtime, since its office was shut down in the nineteenth century.

Therefore, a conference about the legacy of Stephen Hawking held in Jerusalem where Christians looked back to a cross and empty tomb raised intriguing theological conversations. Of course, Hawking was most famous for challenging theological thinking through his work on the origin of the universe rather than the end of the universe. Yet, as Nick Spencer and Hannah Waite have recently argued, for too long, the science and religion debate has fixated on creation, evolution, cosmology, miracles, and quantum theory (Spencer and Waite 2024). They suggest that where science and religion come together, sometimes furiously, sometimes fruitfully, is over the status and nature of the human, and that is most exposed in how science and technology engage with the future. So, it was of interest that one of the scientists featured in the End of the World Night was Stephen Hawking. His brief comments on the future do lead us to some deeper scientific and theological issues.

Hawking Predicting the Future

Hawking's (1988, 1993, 2001; Hawking and Mlodinow 2010) scientific work and subsequent public popularity were founded on general relativity, black holes, and the origin of the universe. But increasingly as a celebrity scientist, he was often drawn outside his field of expertise to more general questions of science, philosophy, and social and humanitarian concerns. Indeed, in his final book, *Brief Answers to the Big Questions*, Hawking (et al. 2018) responds to many of the questions posed to him over the years, especially regarding the challenges of the future such as climate change, the threat of nuclear war, and the development of AI. In this book, he shows his skill in science communication, but there are some deeper themes. The pessimism of some of the scenarios for the future stand alongside the optimistic belief that science plays a critical role in finding solutions.

Hawking used his worldwide fame to highlight great challenges and existential threats for humanity. These comments often became media headlines, even if perhaps taken out of context (Rincon 2018). Lord Martin Rees (2018), the British Astronomer Royal, said of Hawking: "He had robust common sense and was ready to express forceful political opinions. However, a downside of his iconic status was that that his comments attracted exaggerated attention even on topics where he had no special expertise—for instance philosophy, or the dangers from aliens or from intelligent machines."

In an earlier book, *The Universe in a Nutshell,* Hawking (2001, 158) commented that "by 2600 the world's population will be standing shoulder to shoulder, and the electricity use will make the Earth glow red hot." Of course, this is well-known strategy for science communication: "If we don't do anything about this and if things go on as they are, then . . . " He also argues that human DNA will increase in its complexity rapidly and that this needs to happen to live in a complex world and keep ahead of electronic systems.

Of course, warnings about the climate emergency have rightly used this approach but with a lot more subtlety and detailed modeling. The work of the Intergovernmental Panel on Climate Change, begun in the late 1980s, has looked in detail at the effects of the continued emission of greenhouse gases, including the warming of the planet, long-lasting changes in all components of the climate system, and the increasing likelihood of severe, pervasive, and irreversible impacts for people and ecosystems (Jenkins et al. 1990). This is quite a long way from the picture of people standing shoulder to shoulder, but it does give strong motivation that limiting climate change will require substantial and sustained reductions in greenhouse gas emissions, which, together with adaptation, can limit risks (Pachauri and Meyer 2014). The difficulty demonstrated by the last three decades however is that while the scientific scenarios are clear, they do not convince and motivate individuals, institutions, and governments to make

sufficient changes. The key is not just scientific predictions of an apocalyptic future but convincing of the need for moral change. As Sam Berry (2003) pointed out a couple of decades ago, the environmental devastation is due to human selfishness, or what the Christian would call sin.

However, the voices of scientists in the area of climate change were prophetic to Western Christian theologians who had spiritualized the message of the Bible in a way that devalued the physical creation and God's concern for it. Books such as Rachel Carson's (1963) *Silent Spring*, the iconic Earthrise photograph from Apollo 8 (Poole 2008), and the wealth of work in biodiversity and atmospheric physics led to a rediscovery of the Christian doctrine of creation as it applied to ecology and environmental responsibility. Theologians rightly responded to these insights by finding new resources in the Bible and Christian thinking (Horrell 2010; Harakas 1999, 149–62; DeWitt 1991; Moltmann 1985).

The powerful threat of the climate crisis partly led Hawking, with several other scientific voices, to become a strong supporter of the need for humans to move into space and colonize other planets. The argument here was one of resilience towards the future. He was worried by the vulnerability of humanity if we were all on one planet. In addition to the climate crisis, a threat to the planet such as a large asteroid or comet impacting the Earth in a global extinction event, or the rise of artificial intelligence, viruses, or nuclear war would lead to the end of humanity if we were not distributed in space colonies in orbit or on other planets. In 2016, Hawking commented, "Although the chance of a disaster to planet Earth in a given year may be quite low, it adds up over time, and becomes a near certainty in the next thousand or ten thousand years" (Shukman 2016).

Lord Martin Rees (2003, 8) has also set out the many risks presented by the future, adding rogue nanotechnology and experiments eroding the atoms of the Earth or tearing the fabric of space-time. He concludes that the odds "are no better than fifty-fifty that our present civilization on Earth will survive to the end of the present century." In the face of such pessimism, Rees sees the future of human beings in a cosmic rather than Earthbound setting. The development of science coupled with human ingenuity means a spread of human intelligence across the universe would make us less vulnerable to being wiped out by one major event.

Such astro-futurism must also take seriously that when the sun eventually runs out of hydrogen fuel in 4.5 billion years and begins to swell in a red giant phase, the Earth will either be "crispified" in its outer swollen layers or at the very least be completely stripped of its atmosphere (Aungwerojwit et al. 2024). Some speculate that humans will then find other planets outside our solar system capable of sustaining life or terraform other planets to make them capable of sustaining life (Beech 2009). There is also some thinking about directed panspermia, that is, sending simple life from Earth to seed many other planets (Sleator and Smith 2017). Those who advocate such possibilities argue that the special nature of life on the Earth gives us responsibility for sustaining life in

the universe. Here, traditional religious thought is embodied in new ways in the sanctity of life, stewardship of the gift of biological life, and many ethical questions, such as whether we as humans have a right to colonize or even seed other planets that may have their own indigenous life-forms.

It is not only professional scientists who speculate about such scenarios. Hawking is also joined by the new generation of space entrepreneurs (Francis 2023). Elon Musk (2017) has set out a strategy for SpaceX to colonize Mars. Blue Origin's Jeff Bezos prefers industry and human colonies in orbit rather than on other planets (Clifford 2019). Here, Bezos follows the Princeton physicist Gerard K. O'Neill (1982), who described human colonies in space back in the 1970s. For Bezos, moving people and manufacturing to Earth's orbit would deal with the problems of overpopulation, limited energy, and resources, and indeed climate change. Heavy industry would be based on the mining of the moon and asteroids, the sun would provide limitless energy, and pollution would go out into space rather than messing up the Earth's atmosphere. The reduced gravitational forces of orbit would allow new industrial techniques and a different experience of being human. In 2007, Hawking himself famously experienced weightlessness in a specially modified jet that goes through several dives to give passengers an experience of zero gravity. He spoke of the freedom from being wheelchair-bound (*New Scientist* 2007).

Yet, regarding the expansion of humanity into the cosmos, Hawking showed a particular hesitancy. While he was open to the existence of other intelligent life forms in the universe, and supportive of listening for signals in the SETI (Search for Extraterrestrial Intelligence), he was worried about what kind of aliens we might encounter. He therefore joined a few scientists, such as the former Astronomer Royal Martin Ryle, in cautioning against trying to send messages out from Earth. In November 1974, the strongest human-made signal ever transmitted was beamed by the Arecibo radio telescope in the direction of the Great Cluster of the constellation Hercules by Frank Drake. It consisted of a binary message that included numbers, stick figures, chemical formulas, and a crude image of the telescope itself. Ryle objected to this in case it revealed our position to aliens who might then come and conquer us. He suggested that "any creatures out there [may be] malevolent or hungry." Hawking shared this view. He was worried about aliens raiding the Earth for resources. In 2010, he told the Discovery Channel, "We only have to look at ourselves to see how intelligent life might develop into something we wouldn't want to meet" (Riddick, Williams, and Williams 2010).

This not only describes one of the potential problems of aliens, but it is also a reflection upon ourselves as humans. The conflicted nature of human beings is that we demonstrate both goodness and selfishness. Perhaps this is at the heart of the juxtaposition of optimism and pessimism about science and the future. That is, science is done by scientists, with all the frailties of being human. Science as a community with its own checks and balances in terms of

funding, refereeing, and culture can often filter out the mad megalomaniac, but science is often funded by political bodies, which have their own economic and military motives. Individual people and the institutions they populate are seen as both good and fallen by Christian theology.

Even with the successes of science and technology in solving problems from pandemic vaccines to the safety of buildings in earthquake zones, science is embedded in a culture where vaccines are not universally available and the poor cannot afford safe housing and therefore are always more vulnerable. Optimism and pessimism go hand in hand, and the myth of human progress of the early twentieth century that science, technology, and education will lead to human utopia was never fulfilled (Bauckham and Hart 1999). Science discloses and works with a world that is both wonderful and fragile for human beings; indeed, in its exciting new possibilities, it also raises huge risks (Geraci 2012; Blake et. al. 2012; Church and Regis 2012).

In her Gifford Lectures, the philosopher Mary Midgley (1992) discusses the myth of science as salvation. She argues that concepts of salvation, immortality, and mastery of both our bodies and the universe are "adolescent fantasies" that have become embedded into the professional lives of some scientists. She saw danger in a culture where religion no longer is trusted and the myth of science as salvation is uncritically and eagerly accepted as the source of hope (Midgley 1992).

Up to this point, I have used Hawking's brief comments on the future to illustrate the potential and problems of human agency in science. However, there is one scenario of a longer-term future that has been highlighted in contemporary cosmology that is predominately pessimistic and seems to have little capacity for human agency. That is the far future of the universe itself.

The far future of the universe was not a major interest of Hawking's, although some of its physics is shared with his work on the origin of the universe. But such was his celebrity status as a cosmologist that when our picture radically changed in the early twenty-first century, the journal *Science* noted that he had "blessed" the conclusions of this scientific work (Glanz 1999, 34–35).

Hope in an Accelerating Universe?

In 2011, the Nobel Prize was awarded to Saul Perlmutter, Brian Schmidt, and Adam Reiss for new discoveries concerning the expansion of the universe. This work began in 1998 and the Nobel Prize recognized not only the brilliance of the research but also the significance of their discovery. The project used Type 1a supernovae explosions to study how the expansion of the universe was slowing down. Up to that point, physicists were divided on whether a slowing expansion would continue forever or if there was enough mass in the universe—then, the expansion could be reversed into a collapse of a Big Crunch, the opposite of the Big Bang. To the surprise of everyone, they showed that the universe is accelerating in its rate of expansion due to some unknown type of force, the

so-called "dark energy" (Riess et al. 1998; Perlmutter et al. 1999; Riess et al. 2001; Perlmutter 2003; Kirshner 2016). Roughly 70% of the universe seems to be in the form of dark energy. It is thought to fill space uniformly at a very low density of 10^{-27} kg/m^3.

This led to a frenzy of observations and theoretical work to test the original findings and explain them in new theoretical models. While some have questioned the supernovae data, the evidence has built strongly in favor of the universe accelerating (Nielsen et al. 2016; Betoule et al. 2014; Spergel et al. 2007). But what can explain the data, and what is the dark energy? Several suggestions have been made. First, a vacuum energy that is a constant background in the universe. When Einstein applied his general relativity to the universe as a whole, he added a cosmological constant to balance gravity and so give a static universe, neither expanding nor contracting (O'Raifeartaigh et al. 2017). This effectively took the role of gravitating negative masses. According to George Gamow (1970, 44), Einstein remarked that this was the "biggest blunder of his life." Yet, dark energy has raised again this possibility. The vacuum energy acts as a cosmological constant, and it has been suggested that it is produced by quantum theory's possibility of the constant appearance and disappearance of pairs of particles and antiparticles in line with the Heisenberg uncertainty principle (Rugh and Zinkernagel 2002). However, theoretical modeling of this continues to have problems.

Second, quintessence is the possibility of an energy that can vary in its amount and distribution through both space and time. Here, the observed acceleration is caused by the potential energy of a dynamical field, referred to as the quintessence field. There is currently no evidence for quintessence, but some have argued that it may be shown in variation of the fundamental constants in space and time. One of the advantages for quintessence is the observation that the acceleration starts a few billion years into the universe's expansion. If it had started earlier, then galaxies would not have been able to form. Some have suggested that the quintessence field does not switch on the acceleration until a certain point in the universe's history marked by matter–radiation equality.

Third, it may be that our understanding of how gravity works on the large-scale universe is limited. In this explanation, what we call dark energy is not a new force but a variation in general relativity's explanation of gravity. It may be that both dark matter and dark energy modify the laws of gravity at various scales. This may mean that dark energy and dark matter interact or can be unified (Oztas et al. 2018). Others have argued for a modification of general relativity, although some of the first results from the detection of gravitational waves are not consistent with this (Joyce et al. 2016; Lombriser and Lima 2017). It is also important to note that some have argued dark energy is a mirage and not needed to understand the universe, but this has not been generally accepted by cosmologists (Mattsson 2010). A number of experiments are currently

searching for answers to these candidates for dark energy, using both ground-based and orbiting telescopes (Castelvecchi 2023; Huterer and Shafer 2018).

The long-term future of an accelerating universe is heat death. But if the effect of dark energy keeps increasing, the universe will experience a "Big Rip," where gravitationally bound structures would be ripped apart and eventually other forces such as the electrical and nuclear forces will be overcome, leading to the ripping apart of atoms.

The lack of any agreement on the best theoretical model and the need for more observations to constrain these models gives quite a large solution space to some of this discussion. Within this solution space, not only scientific preferences but also more philosophical preferences can be expressed. In particular, the pessimism of a future where an accelerating universe leads to a future universe that is cold and dark, and where structures no longer can be sustained, is difficult for scientists to maintain.

For example, Jeremiah P. Ostriker and Paul J. Steinhardt comment on different options:

> As acceleration takes hold over the next tens of billions of years, the matter and energy in the universe will become more and more diluted and space will stretch too rapidly to enable new structures to form. Living things will find the cosmos increasingly hostile. If the acceleration is caused by vacuum energy, then the cosmic story is complete: the planets, stars and galaxies we see today are the pinnacle of cosmic evolution.

However, they go on to try and find hope in quintessence:

> But if the acceleration is caused by quintessence, the ending has yet to be written. The universe might accelerate forever, or the quintessence could decay into new form of matter and radiation, repopulating the universe . . . [T]he universe had once been alive and then died, only to be a given a second chance. (Ostriker and Steinhardt 2001)

It is interesting to see the passion for the universe to be given a second chance. Of course, scientists will be guided by the data, but they do science in the context of culture, a diversity of religious beliefs, and their own fundamental beliefs and hopes. In the 1980s, I worked with a young Indian cosmologist, Dr. N. C. Rana, on the dark matter problem (Rana and Wilkinson 1987). At that point, the scientific community was wondering whether there was enough dark matter in the universe to reverse the expansion. Rana was very keen on this, even if the observational evidence suggested the opposite. He was very honest that as a Hindu he was drawn to an oscillating universe resonating with beliefs in reincarnation.

Throughout discussions of the end of the universe, several scientists have resisted the pessimism of the accelerating universe. Some have pointed to the possibility that this universe may be one of many; therefore, even if this universe ends in futility, there are other universes that will continue to exist and may contain life. Many universes appear in many different theories (Carr 2007; Gribbin 2009; Friederich 2021; Halpern 2024). The accelerating universe seems to rule out a very popular model of the previous decades. This was the view mentioned previously that the universe would expand and then contract under gravity, leading to a bounce into another universe. This eternal oscillating existence of the universe finds a termination to its cycle in the acceleration and eternal expansion. Of course, earlier universes with different laws of physics can never be ruled out, but they do not give any hope for the present and future. Another model of multiverse arises out of inflationary theories that explain certain features of the early universe, but some of these have the consequence that our universe is one universe in a sea of bubble universes, rather like bubbles in a foam. In all these multiverse theories, there remains the fundamental problem of passing the information of one universe to another. Here is a metaphysical hope rather than any real evidence of other universes or indeed of life in these other universes. That is why John Polkinghorne (2002, 27) comments that such a scenario presents "a scene of occasional islands of meaningfulness erupting within an ocean of absurdity."

It can be noted in passing that in his final paper, Hawking makes a contribution to this area. Having employed multiverse in his book *The Grand Design* as a way of dealing with the very beginning of the universe, he and coauthor Thomas Hertog argue against eternal inflation and multiverse (Hawking and Hertog 2018). They employ string theory to suggest a beginning to the universe with no time at all. In *A Brief History of Time*, Hawking had tried to deal with the problem of how science could describe the very first moment of the universe's history by speculating on a theory of quantum gravity where time becomes a dimension of space. In contrast, in this new work, time ceases to have any meaning. This is an illustration of some of the uncertainty around the beginning of the universe but also a reminder that the beginning and the future are intricately linked.

Other physicists, rather than finding hope in other universes, have attempted to find hope by appealing to the myth of human progress, or science as savior. Freeman Dyson and Frank Tipler were struck by the ability of humans to manipulate the environment of the Earth and wonder if this could be extrapolated forward to engineering projects on a much larger cosmic scale. Dyson suggests genetic engineering of biological life could lead to life having a longer survival time in a cold, expanding universe. Then, consciousness could be transferred to non-biological structures that could exist at very low temperatures, for example, a complex dust cloud. In this way, "life and intelligence are potentially immortal" (Dyson 1988). Tipler (1994) saw consciousness transferred to computer neural

networks expanding across the universe. However, the Dyson and Tipler models were constructed on the basis of an expanding but not accelerating universe. The accelerating universe makes it impossible for such structures to be maintained, which means science cannot promise that life and intelligence are immortal.

In the end, the accelerating universe predicts a future of the universe that is one of futility. Paul Davies (2002, 48) writes that an "almost empty universe growing steadily more cold and dark for all eternity is profoundly depressing."

Engaging Science with Theology

If science cannot provide hope in the face of the long-term future of the universe, might Christian theology bring a contribution to this End of the World night? It may be worth pausing here for a moment to consider a few options for how science can engage with theology. This is to avoid the charge that the theologian is simply trying to insert God into the gaps of scientific uncertainty or tell a story that has no real interaction with the scientific story. Some years ago, Ian Barbour (2000, 113) produced a now widely used fourfold typology of conflict, independence, dialogue, and integration to characterize the relationships between science and religion. While others have critiqued Barbour and suggested more nuanced models (Stenmark 2013), it is instructive to locate our discussion of the end of the universe within this framework.

The conflict model, used by both scientific atheists and six-day creationists, pits science in warfare with religion, each striving for complete victory over the other. Yet in terms of the end of the universe, this approach is not convincing, whichever end of the theological spectrum it comes from. Oxford chemist and atheist Peter Atkins (1995, 129) wrote, "Science has never encountered a barrier it has not surmounted or that we can reasonably suppose it has power to surmount." Yet as we have seen, that will not quite work for the end of the universe. At the same time, the six-day creationist case (within the Christian church), which also uses the conflict model, is severely undermined by the futility of the physical universe. To argue that God created a perfect creation some 6,000 years ago does not do justice to a universe that is falling apart. This creation does not seem to be a perfect end product. Creationism neglects both the importance of eschatology for the physical creation and a wealth of scientific observations. Creationists either argue against the scientific data regarding the age and expansion of the universe or argue that the futility is simply the result of a cosmic Fall. While I acknowledge that the doctrine of the Fall should not be ignored, it is not strong enough to support such creationist claims (Berry and Noble 2009).

The second model, that of independence, sees science and religion in separate domains. This has been advocated by theologians in the Barthian tradition, philosophers exploring the nature of language, and some scientists such as Stephen Jay Gould (1999, 207–8). While of course science and religion

have different foci in their exploration and description of the world, scientific predictions of the future and the end of the universe in particular challenge such a complete separation. Questions of hope and salvation are at the heart of such discussions. In fact, it can be seen even in the language used by scientists such as Dyson and Tipler that they fall into the fallacy of believing that science and religion are non-interactive disciplines. For example, Tipler (1994, xiii) wants to "rescue eschatology from the hands of theologians who with a few exceptions . . . are quite ignorant of it." For the theologian, the belief that the universe is God's creation must then take seriously the reality of what we can see of the future in the present. Just as with creation care in the midst of the climate emergency, science can bring new insights and challenges to the theological task. So, when it comes to the futility of the future of the universe, as a Christian theologian, I want to take this seriously.

While independence would mean there is no engagement at all, Barbour's model of integration wants to build science and theology into a seamless philosophy. At the simplest form of integration, some have looked for God to fill the gaps of scientific ignorance. Yet, such a program of integration does not take seriously enough the complexity, rate of change, and ambiguity of the scientific picture. Both science and theology are provisional activities. A god of the gaps is often pushed out of the gap and becomes irrelevant as science explains more and more of its own territory.

Some might say that the difficulty of predicting the end of the universe is unique in this provisional texture, but the provisionality exists in all science. Barbour's own more nuanced commitment to integration pushed him towards process theology, which uses an analogy between God's action and our experience as agents and attempts to proceed by assimilating the nature of the universe to our nature. Developed from the metaphysics of A. N. Whitehead with theological development by Charles Hartshorne, process theology reacts against a mechanistic universe by suggesting each event in the universe has a psychic pole and a material pole, and God works as an agent at the subjective level, exercising power by persuasion. This allows space for human agency to be maintained but has been critiqued for severely limiting God's ability to exercise agency in any significant way (see, for example, Gunton 1978). Certainly, it has a problem with the futility of the future of the universe, with God as spectator as the whole thing falls apart.

For me, the alternative and fourth model is much more convincing. This is dialogue and sees science and theology in a series of open-ended conversations. While they come from different perspectives with their own methodologies, there is common ground for the conversation. This may be in the questions raised within the different disciplines that cannot be fully answered by them. It may be that the different methodologies have some common foundations and interaction. It may be that one discipline gives resources to the other in insights or analogies. For example, concepts from science can be used as analogies for

talking about God's relation to the world, and models of God's action may be furthered enriched or constrained by scientific insights into the nature of the world. It may be that in conversation one discipline is reminded of its own limits. The conversation may never reach integration, but its usefulness is in enriching the partner discipline's.

We have already seen that the exploration of the end of the physical universe within contemporary cosmology has involved questions of futility, progress, and the limits of science as savior. Such insights raise major issues for the Christian theologian. The end of the universe points to a future of futility for the physical and with it the end of the survival of intelligent life within the universe. It raises the question of how the end can be understood within a theology of creation. Some theologians will say that this is so far in the future that it is irrelevant, while others have concentrated their thinking about the future on the future of the Earth, the individual believer, or the church. Yet, the physicist will pursue the conversation. A Christian doctrine of creation does raise the question of what God thinks of the physicality of creation. In addition, the end of a story is key to understanding the story, however far in the future that may be.

Hawking was never reserved about bringing God into the conversation with the results and speculations of cosmology. As noted, this was often in connection with the origin of the universe, where he initially, in *A Brief History of Time*, attacked a deistic rather than fully Christian picture of God on the basis of his speculative thinking about quantum gravity (Wilkinson 2001; Wilkinson and Hutchings 2020). Deism believes in a God who started the universe and then retired a safe distance from it, not doing anything of note in the universe. This is a long way from traditional Christian theism, which sees God sustaining the universe at every moment through the faithfulness of the laws of physics and becoming a human being in the life, death, and resurrection of Jesus. Hawking was right in attacking such a deistic god of the gaps who simply started off the initial state of the universe and then had nothing more to do with it. Indeed, Hawking's work was welcomed by several of us who wanted to think more deeply about God's creative work.

During his career and especially as his media fame grew, Hawking's public comments on the existence of God became more negative. Sometimes he followed Einstein, who did not believe in any personal God but equated god with "nature." In a series for the Discovery Channel, Hawking (2011) gave a quote that has often been repeated:

> We are each free to believe what we want, and it is my view that the simplest explanation is there is no God. No one created the universe, and no one directs our fate. This leads me to a profound realization. There is probably no heaven, and no afterlife either. We have this one life to appreciate the grand design of the universe, and for that, I am extremely grateful.

The Christian theologian might want to pick up on at least two things here! The first is to ask to whom Professor Hawking is grateful. For some, the word "design" might also raise the question of agency. The second may be to point out the apparent huge leap from "no God" to "no heaven and no afterlife." Indeed, others from parts of other faith communities such as Buddhism may not follow such logic. Yet, within Christian theology, I follow Professor Hawking on this point. Hope for life to come is entirely based in belief in a creator God who acts within the universe. It is to this that I now turn in a mode of dialogue.

Gazing Forward in Conversation with the Bible

In Paul's letter to the Romans, after seven chapters discussing human rebellion and the gift of salvation through faith in the atoning work of Jesus, he turns to what this means for the future. One consequence is that there is no condemnation for those who are in relation with the risen Christ (Romans 8:1); another is that whatever happens in the future will not separate us from the love of God in Jesus (Romans 8:38–39). Sandwiched in between is a short passage that reflects on the present and our experiences in this creation (Romans 8:18–22):

> I consider that our present sufferings are not worth comparing with the glory that will be revealed in us. For the creation waits in eager expectation for the children of God to be revealed. For the creation was subjected to frustration, not by its own choice, but by the will of the one who subjected it, in hope that the creation itself will be liberated from its bondage to decay and brought into the freedom and glory of the children of God. We know that the whole creation has been groaning as in the pains of childbirth right up to the present time.

Of course, Paul has no knowledge of scientific predictions about the end of the universe, but he senses a creation in bondage to decay. Christian theology holds creation good because it is created by God, yet at the same time, this theology is characterized by frustration, decay, and groaning for something beyond this present creation.

In the eighteenth century, the founder of Methodism, John Wesley, was particularly moved by this passage. He was fascinated by the science of his day, especially Thomas Hartley's *Paradise Restored*, Thomas Burnet's *Theory of the Earth*, and James Knight's *A Discourse on the Conflagration and Renovation of the World*. As part of the evangelical revival, he had become a noted preacher of the necessity of new birth in the conversion of an individual (Whitefield et al. 1986). He saw the church as God's new community, but as Randy Maddox has argued, Wesley's perceived scope of God's work was not confined to human beings. At the heart of the New Testament of hope, he saw the promise of new creation—an action of God leading to physical change of key importance (Maddox 2004). His thinking led him to argue in his 1781 sermon "The General

Deliverance," which used Romans 8:19–22 as its text, that a range of animals would be present in this renewed creation.

Wesley was bringing biblical insights into conversation with the science of his day and in doing so speaking afresh of God's work in the world. Can we do a similar thing in terms of scientific predictions of the future? I have explored such material in greater depth elsewhere (Wilkinson 2010, 53–114; 2017, 97–110), but how might such insights be in dialogue with some of the scientific scenarios I have described in this article?

First, I note, with Wesley, the importance of the theme of new creation within a range of biblical genres. New creation is not about a wispy, greyish, and ghostly heaven to which souls are liberated at the point of death, having left this physical world behind completely. In the book of Revelation (21:1), the vision is of "a new heaven and a new earth." It is about God doing something with the totality of existence, a point Wesley notes in speculating about the future of animals as well as men and women. The question of the futility of the universe and the danger of science being used for power and injustice are here in conversation with a creator who still is concerned with the physical. The "new heaven and new earth" is a picture not of separation of God's concern but a unity of God's concern that is as much about the "spiritual" life of inner religious experience as the physical life of science and technology. Here is an affirmation of the role of science as an enduring gift of God and the vocations of the scientist to explore the world and the technologist or engineer to develop the potential of the world for good. At the same time, it is about something new, not about keeping this creation alive for as long as possible. Here is a critique of the hope given by the "eschatological scientists" such as Dyson and Tipler. Hope is not to be found in life continuing in interstellar gas clouds. This stands alongside the critique of Christian theology, especially that found in funeral liturgy and Christian hymns that paint an overly human-centered and non-physical hope (Wright 2007).

Second, new creation is a possibility not because of human scientific achievement but because of a creator God. Thinking about new creation in the Bible is continually linked to God's original creative work, and hope for the future is built on an understanding of God as creator (Isaiah 65:17–25). Whatever the circumstances, creation is not limited to its own inherent possibilities, because the God of creation is still at work. This is in stark contrast to the myth of human progress and the belief that science can be the ultimate savior. Thus, the sovereignty of God in creation is the basis of hope in new creation. This raises questions of whether God can act in the universe. These questions of providence are complex, but a God who is not free to work in the universe must watch the slow heat death of creation. Scientific predictions of the end of the universe are a reminder that models of providence must take seriously the universe over its entire history rather than just its present state. Further, those models, which picture the universe as God's body, work reasonably well with a universe of its present structure, variety, and life but are weak when we look forward to a universe

that decays in the futility of a lifeless and unstructured heat death. Models that stress immanence too much at the expense of transcendence face a bleak future in the end of the universe. At the extreme limit of this, models where God is a superior intelligence totally contained in the universe, as have been developed by some scientists in a revamped natural theology, become gods who eventually will die (see, for example, Hoyle 1983). Likewise, models that stress God's non-intervention in the universe are presented with an interesting question in terms of the end of the universe: Is God sustaining a process that will end in futility?

Richard Bauckham (1993, 51) rightly comments:

> A God who is not the transcendent origin of all things but a way of speaking of the immanent creative possibilities of the universe itself cannot be the ground of ultimate hope for the future of creation. Where faith in God the Creator wanes, so inevitably does hope for the resurrection, let alone the new creation of all things.

Third, new creation is a transformation of the present creation rather than a total annihilation and beginning again. Some religious thinkers have welcomed the death of the universe either because it resonates with a form of reincarnation where there is no continuity between the past, the present, and the future, or because they view this world as completely infected by evil and therefore God needs to start again. Some Christian commentators have pointed out a verse in 2 Peter that in many English translations reads, "But the day of the Lord will come like a thief. The heavens will disappear with a roar; the elements will be destroyed by fire, and the earth and everything done in it will be burned up" (2 Peter 3:10). As might be imagined, this has caused some commentators to draw too close a connection between the apocalyptic imagery of the Bible and scientific scenarios. For example, Bo Reicke (1980) comments:

> The solar system and the great galaxies, even space-time relationships will be abolished . . . All elements which make up the physical world will be dissolved by heat and utterly melt away. It is a picture which in an astonishing degree corresponds to what might actually happen according to modern theories of the physical universe.

That "[a]ll elements which make up the physical world will be dissolved . . . and utterly melt away" conveys the sense that this physical universe will be destroyed by God. In fact, the verse does not mean this at all. Bauckham is correct in seeing such passages as 2 Peter 3:10–13 in the context of the Jewish apocalyptic. In contrast to the dissolving and renewing fire of the Stoics, and the Zoroastrian view of purification, here the emphasis is on judgment. Rather than the end of verse 10 speaking about all things being burned up, it is better understood as "laid bare." Bauckham (1983, 326) concludes that such passages

"emphasise the radical discontinuity between the old and the new, but it is nevertheless clear that they intend to describe a renewal not an abolition of creation." As Polkinghorne has argued, the first creation was *ex nihilo*, while the new creation will be *ex vetere*. In other words, the old creation is God's bringing into being a universe that is free to exist "on its own" in the ontological space made available by the divine kenotic act of allowing the existence of something wholly other; the new creation is the divine redemption of the old (Polkinghorne 1994, 167). Once again, this theme is an affirmation of the physical creation and the transformative capacity of science and technology. Environmental concern and action are important because God's purposes are not to throw away this evil world but to use both divine and human agency to transform it. At this, the point might be raised: Could humans do anything, especially in terms of Earth's environment, that has implications for the whole universe? This is fair, but central to the parables of Jesus such as the mustard seed is that the nature of the Kingdom is counterintuitive on this point, that the small may profoundly affect the bigger picture. The new creation is already begun in the life, death, and resurrection of Jesus, giving hope and confidence that something on the Earth does have cosmic consequences.

Fourth, the nature of that divine agency is represented in the Bible both in continual process and in particular event. In their discussion of Christian hope, Bauckham and Trevor Hart are right to emphasize the importance of the biblical tradition of the second coming of Christ (Bauckham and Hart 1999). This may feel a strange topic to introduce into dialogue with science. It is often used in popular expressions of Christianity to paint an apocalyptic picture of end times suffering and the final triumph of Christians over the world. Yet for the mainstream Christian tradition, it is a reminder that biblical eschatology, that is, thinking about the future, has a focus on Jesus Christ. Further, the images used are suggestive of an eschatological event that is both in space and time and yet transcends space and time (1 Thessalonians 4:13–5:11). It is a reminder of the importance of the particular action of God within God's more general activity of sustaining and transforming creation. Thus, the redemption of this creation is pictured in terms of a long process, working through contemporary structures as well as a specific event of judgment. Former Astronomer Royal Sir Arnold Wolfendale, who returned to Christian faith later in his life, remarked to me that there is some parallel here to the moment of phase change within a process. For example, in the early universe, the period of early expansion called inflation switches on and off, changing the universe fundamentally. The acceleration of the universe due to dark energy certainly seems to also switch on a few billion years after the Big Bang. Now, I am not suggesting in any way an interventionist God who is responsible for such things. But the analogy might be instructive for an understanding of how a particular form of engagement by God alongside the normal sustaining of the universe might give a fulfilment of new creation.

Fifth, the resurrection of Jesus is central in all of this. It provides the evidence that God has agency within the space-time history of the world as well as a model for the nature of new creation. The scientist will want to ask about evidence. Christian proclamation about the resurrection has always put forward the historical evidence for the bodily resurrection of Jesus (Wright 2003). The scientist will recognize that this is different from many areas of scientific evidence. There is no repeatability of the experiment but rather a collecting of data and then questioning of the best model that explains the evidence for a one-off event. This is the historical method, and there are areas of science that at times share this. The Big Bang is a one-off event, and cosmology has collected evidence and then reconstructed the best model that explains that evidence. The resurrection as an unusual act of God outside God's normal ways of working may never be open to scientific explanation, but the scientist may be guided by the evidence even if the model defies everyday experience or common sense.

But the resurrection is also, in the words of Paul, "the first fruits" of that which is to come (1 Corinthians 15:20). What is striking about the gospel writers' description of the risen Jesus is both the continuity and discontinuity with the Jesus who is crucified. The risen Jesus seems to be physical in terms of eating and even pointing to the scars of the crucifixion on his body. Yet, he seems to be different. The disciples do not immediately recognize him, and he appears in rooms with locked doors. So, if the resurrection is the initial picture of God's transformative work, then there should be both continuity and discontinuity in the relationship of creation and new creation, as there was in the relationship between Jesus before the cross and Jesus risen. Once again, the empty tomb is a sign that God's purpose for the material world is that it should be transformed not discarded. But if resurrection affirms creation, then it also points forward to new creation.

Continuity and discontinuity in the transformation of the physical universe may be located in the nature of matter, space, and time. To take time as an example, the resurrected Jesus does not seem limited by space and time. In new creation, the continuity may be that time is real, but the discontinuity may be that time no longer limits us in the way it does in this creation. It could be argued that the resurrection body is characterized by decay's reversal, that is, a purposeful flourishing. In this creation, time is associated with decay and growth, but in new creation, time might be simply about growth (Thiselton 2012). I am therefore suggesting that our experience of time in the physical universe is a small and limited part of an ontologically real time we might call eternity.

Conclusion

Consideration of the end of the world, whether in pop culture or in serious scientific research, illustrates a series of deeper questions for the understanding of the role of science and for Christian theology. Trust in science as ultimate

savior is undermined by the impossibility of human agency in the accelerating universe and the recognition that in those scenarios where agency is possible, it is dependent on both the goodness and fallenness of scientists. Science can make a positive difference to the future, but it does not and cannot solve all problems.

Christian theology, which is centered on the bodily resurrection of Jesus, affirms the role of scientists in working for future good, but it also cautions that only God can transform this creation into new creation. The accelerating universe and the consequent heat death provide key questions for theology, which are opportunities more than problems. It highlights a greater engagement with scripture and the need to engage more with themes of new creation, eschatological transformation, and resurrection.

An "end of the world night" is therefore ideally located between Good Friday and Easter Sunday.

References

Atkins, Peter. 1995. "The Limitless Power of Science." In *Nature's Imagination*, edited by John Cornwall, 122–32. Oxford: Oxford University Press.

Aungwerojwit, Amornrat, Boris T. Gänsicke, Vikram S. Dhillon, Andrew Drake, Keith Inight, Thomas G. Kaye, T. R. Marsh, et al. 2024. "Long-Term Variability in Debris Transiting White Dwarfs." *Monthly Notices of the Royal Astronomical Society* 530 (1): 117–28.

Barbour, Ian. 2000. *When Science Meets Religion: Enemies, Strangers or Partners?* London: SPCK.

Bauckham, Richard. 1983. *Jude 2 Peter*. Waco, TX: Word Books.

———. 1993. *The Theology of the Book of Revelation*. Cambridge: Cambridge University Press.

Bauckham, Richard, and Trevor Hart. 1999. *Hope Against Hope: Christian Eschatology in Contemporary Context*. London: DLT.

Beech, Martin. 2009. *Terraforming: The Creating of Habitable Worlds*. Astronomers' Universe. New York: Springer.

Berry, R. J. 2003. *God's Book of Works: The Nature and Theology of Nature*. London: Continuum.

Berry, R. J., and Thomas A. Noble, eds. 2009. *Darwin, Creation and the Fall: Theological Challenges*. Nottingham: Apollos.

Betoule, M., R. Kessler, J. Guy, J. Mosher, D. Hardin, R. Biswas, P. Astier, et al. 2014. "Improved Cosmological Constraints from a Joint Analysis of the Sdss-Ii and Snls Supernova Samples." *Astronomy & Astrophysics* 568:A22.

Blake, Charlie, Claire Molloy, and Steven Shakespeare. 2012. *Beyond Human: From Animality to Transhumanism*. London: Continuum.

Carr, Bernard. 2007. *Universe or Multiverse?* Cambridge: Cambridge University Press.

Carson, Rachel. 1963. *Silent Spring*. London: Hamilton.

Castelvecchi, Davide. 2023. "These Incredible Images Are the First from Dark-Energy Telescope Euclid." *Nature*, November 8.

Church, George M., and Ed Regis. 2012. *Regenesis: How Synthetic Biology Will Reinvent Nature and Ourselves*. New York: Basic Books.

Clifford, Catherine. 2019. "Jeff Bezos: Forget Mars, Humans Will Live in These Free-Floating Space Pod Colonies." https://www.cnbc.com/2019/03/08/jeff-bezos-mount-everest-is-a-garden-paradise-compared-to-mars.html.

Davies, Paul. 2002. "Eternity: Who Needs It?" In *The Far-Future Universe: Eschatology from a Cosmic Perspective*, edited by George F. R. Ellis, 41–52. Radnor, PA: Templeton Foundation Press.

DeWitt, Calvin B. 1991. *The Environment and the Christian: What Does the New Testament Say About the Environment?* Grand Rapids, MI: Baker Book House.

Dyson, Freeman J. 1988. *Infinite in All Directions*. New York: Harper & Row.

Francis, Matthew R. 2023. "Musk and Bezos Offer Humanity a Grim Future in Space Colonies." *Scientific American*, June 26.

Friederich, Simon. 2021. *Multiverse Theories: A Philosophical Perspective*. New York: Cambridge University Press.

Gamow, George. 1970. *My World Line: An Informal Autobiography*. New York: Viking Press.

Geraci, Robert M. 2012. *Apocalyptic AI: Visions of Heaven in Robotics, Artificial Intelligence, and Virtual Reality*. Oxford: Oxford University Press.

Glanz, James. 1999. "Hawking Blesses the Accelerating Universe." *Science* 284 (5411): 34–35.

Gould, Stephen Jay. 1999. *Rocks of Ages: Science and Religion and the Fullness of Life*. New York: Ballantine.

Gribbin, John. 2009. *In Search of the Multiverse: Parallel Worlds, Hidden Dimensions, and the Ultimate Quest for the Frontiers of Reality*. Hoboken, NJ: Wiley.

Gunton, Colin. 1978. *Becoming amid Being: The Doctrine of God in Charles Hartshorne amid Karl Barth*. Oxford: Oxford University Press.

Jenkins, G. J., J. J. Ephraums, J. T. Houghton, and Intergovernmental Panel on Climate Change. 1990. Working Group I. *Climate Change: The IPCC Scientific Assessment*. Cambridge: Cambridge University Press.

Halpern, Paul. 2024. *The Allure of the Multiverse: Extra Dimensions, Other Worlds, and Parallel Universes*. New York: Basic Books.
Harakas, Stanley S. 1999. "The Earth Is the Lord's: Orthodox Theology and the Environment." *Greek Orthodox Theological Review* 44:149–62.
Hawking, S. W., and Thomas Hertog. 2018. "A Smooth Exit from Eternal Inflation?" *Journal of High Energy Physics* 2018 (4): 147.
Hawking, Stephen. 1988. *A Brief History of Time*. London: Bantam.
———. 1993. *Black Holes and Baby Universes*. London: Bantam.
———. 2001. *The Universe in a Nutshell*. London: Bantam.
———. 2011. "Curiosity: Did God Create the Universe?" *Discovery Communications*, August 7.
Hawking, Stephen, Eddie Redmayne, Kip S. Thorne, and Lucy Hawking. 2018. *Brief Answers to the Big Questions*. New York: Bantam.
Hawking, Stephen, and Leonard Mlodinow. 2010. *The Grand Design*. London: Bantam.
Horrell, David G. 2010. *The Bible and the Environment: Towards a Critical Ecological Biblical Theology*. Biblical Challenges in the Contemporary World. London: Equinox.
Hoyle, Fred. 1983. *The Intelligent Universe*. London: Michael Joseph.
Huterer, Dragan, and Daniel L. Shafer. 2018. "Dark Energy Two Decades After: Observables, Probes, Consistency Tests." *Reports on Progress in Physics* 81 (1): 016901.
Joyce, Austin, Lucas Lombriser, and Fabian Schmidt. 2016. "Dark Energy Versus Modified Gravity." *Annual Review of Nuclear and Particle Science* 66 (1): 95–122.
Kirshner, Robert P. 2016. *The Extravagant Universe: Exploding Stars, Dark Energy, and the Accelerating Cosmos*. Princeton, NJ: Princeton University Press.
Lombriser, Lucas, and Nelson Lima. 2017 "Challenges to Self-Acceleration in Modified Gravity from Gravitational Waves and Large-Scale Structure." *Physics Letters B* 765:382–85.
Maddox, Randy L. 2004. "Nurturing the New Creation: Reflections on a Wesleyan Trajectory." In *Wesleyan Perspectives on the New Creation*, edited by M. Douglas Meeks, 21–52. Nashville, TN: Kingswood Books.
Mattsson, Teppo. 2010. "Dark Energy as a Mirage." *General Relativity and Gravitation* 42 (3): 567–99.
Midgley, Mary. 1992. *Science as Salvation: A Modern Myth and Its Meaning*. Gifford Lectures. London: Routledge.
Moltmann, Jürgen. 1985. *God in Creation: An Ecological Doctrine of Creation*. San Francisco: Harper and Row.
Musk, Elon. 2017. "Making Humans a Multi-Planetary Species." *New Space* 5 (2): 46–61.
New Scientist. 2007. "Stephen Hawking Gets Taste of Zero Gravity." April 26. https://www.newscientist.com/article/dn11730-stephen-hawking-gets-taste-of-zero-gravity/.
Nielsen, J. T., A. Guffanti, and S. Sarkar. 2016. "Marginal Evidence for Cosmic Acceleration from Type Ia Supernovae." *Scientific Reports* 6 (1): 35596.
O'Neill, Gerard K. 1982. *The High Frontier: Human Colonies in Space*. Garden City, NY: Anchor Books.
O'Raifeartaigh, Cormac, Michael O'Keeffe, Werner Nahm, and Simon Mitton. 2017. "Einstein's 1917 Static Model of the Universe: A Centennial Review." *European Physics Journal H* 42:431–74.
Ostriker, Jeremiah P., and Paul J. Steinhardt. 2001. "The Quintessential Universe." *Scientific American* 284 (January): 46.
Oztas, A., E. Dil, and M. L. Smith. 2018. "The Varying Cosmological Constant: A New Approximation to the Friedmann Equations and Universe Model." *Monthly Notices of the Royal Astronomical Society* 476 (1): 451–58.
Pachauri R. K., and L. A. Meyer, eds. 2014. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva: IPCC.
Perlmutter, S. 2003. "Supernovae, Dark Energy, and the Accelerating Universe." *Physics Today* 56 (April): 53–60.
Perlmutter, S., et al. 1999. "Measurements of Omega and Lambda from 42 High-Redshift Supernovae." *Astrophysical Journal* 517 (2): 565–86.

Polkinghorne, John. 1994. *Science and Christian Belief*. London: SPCK.
———. 2002. *The God of Hope and the End of the World*. London: SPCK.
Poole, Robert. 2008. *Earthrise: How Man First Saw the Earth*. New Haven, CT: Yale University Press.
Rana, N. C., and D. A. Wilkinson. 1987. "The Chemical Evolution of the Galaxy and the Dark Matter Problem." *Monthly Notices of the Royal Astronomical Society* 226 (2): 395–422.
Rees, Martin. 2003. *Our Final Hour*. New York: Basic Books.
———. 2018. "Stephen Hawking: An Appreciation by Lord Martin Rees." Address given at the Service of Thanksgiving, Westminster Abbey, June 15. https://www.cam.ac.uk/stephen-hawking-an-appreciation-by-lord-martin-rees.
Reicke, Bo. 1980. *The Epistles of James, Peter, and Jude*. The Anchor Bible. 2nd ed. Garden City, NY: Doubleday.
Riddick Iain, Martin Williams and Nathan Williams. 2010. *Into the Universe with Stephen Hawking*. Discovery Channel. https://www.imdb.com/title/tt1655078/.
Rincon, Paul. 2018. "Stephen Hawking's Warnings: What He Predicted for the Future." *BBC News*, March 15. https://www.bbc.co.uk/news/science-environment-43408961.
Riess, A. G., et al. 1998. "Observational Evidence from Supernovae for an Accelerating Universe and a Cosmological Constant." *Astronomical Journal* 116:1009–38.
Riess, A. G., et al. 2001. "The Farthest Known Supernova: Support for an Accelerating Universe and a Glimpse of the Epoch of Deceleration." *Astrophysical Journal* 560 (1): 49–71.
Rugh, S. E., and H. Zinkernagel. 2002. "The Quantum Vacuum and the Cosmological Constant Problem." *Studies in History and Philosophy of Science, Part B: Studies in History and Philosophy of Modern Physics* 33 (4): 663–705.
Shukman, David. 2016. "Hawking: Humans at Risk of Lethal 'Own Goal.'" *BBC News*, February 19. https://www.bbc.com/news/science-environment-35344664.
Sleator, Roy D., and Niall Smith. 2017. "Directed Panspermia: A 21st Century Perspective." *Science Progress* 100 (2): 187–93.
Spencer, Nick, and Hannah Waite. 2024. *Playing God: Science, Religion and the Future of Humanity*. London: SPCK.
Spergel, D. N., et al. (WMAP collaboration). 2007. "Wilkinson Microwave Anisotropy Probe (WMAP) Three-Year Results: Implications for Cosmology." *Astrophysical Journal Supplement Series* 170 (2): 377–408.
Stenmark, Mikael. 2013. "Typologies in Science and Religion." In *Encyclopedia of Sciences and Religions*, edited by Anne L. C. Runehov and Lluis Oviedo, 2309–15. Dordrecht: Springer.
Thiselton, Anthony C. 2012. *The Last Things: A New Approach*. London: SPCK.
Tipler, Frank J. 1994. *The Physics of Immortality*. London: Weidenfeld & Nicolson.
von Balthasar, Hans Urs. 1960. "Umrisse der Eschatologie." In *Verbum Caro*. Einsiedeln, Switzerland: Johannes Verlag.
Whitefield, George, John Wesley, and Timothy Lawrence Smith. 1986. *Whitefield & Wesley on the New Birth*. Grand Rapids, MI: F. Asbury Press.
Wilkinson, David. 2001. *God, Time and Stephen Hawking*. Crowborough, UK: Monarch.
———. 2010. *Christian Eschatology and the Physical Universe*. London: T & T Clark.
———. 2017. "The Accelerating Universe and New Creation: Christian Eschatology in the Face of Scientific Futility." In *Game Over? Reconsidering Eschatology*, edited by Christophe Chalamet, Andreas Dettwiler, Mariel Mazzocco and, Ghislain Waterlot, 97–110. Berlin: De Gruyter.
Wilkinson, David, and David Hutchings. 2020. *God, Stephen Hawking and the Multiverse: What Hawking Said, and Why It Matters*. London: SPCK.
Wright, N. T. 2003. *The Resurrection of the Son of God*. London: SPCK.
———. 2007. *Surprised by Hope*. London: SPCK.