

Reviews

Entropic Creation: Religious Contexts of Thermodynamics and Cosmology. By Helge S. Kragh. Aldershot, England: Ashgate, 2008. 272 pages. \$114.95.

Rudolf Clausius, one of the founders of the second law of thermodynamics, concluded the memoir of 1865 in which he introduced the concept of entropy into physics as follows: “The energy of the world is constant. The entropy of the world tends to a maximum.” Helge Kragh’s wide-ranging study explores the various ways in which different authors understood the content and implications of Clausius’ second dictum.

The book may be of interest to readers of *Zygon* because of its detailed discussion of an argument that was popular from the 1860s to around 1920. The basic argument, of which there were many variants, goes as follows: If the entropy of the universe tends to a maximum, the universe eventually will come to an end. This is because all of its energy will eventually be converted to heat energy, and all of the heat energy will reach thermal equilibrium, in which state no work can any longer be extracted—thus the “heat death” that is vividly described in many late-nineteenth-century works such as Camille Flammarion’s *La fin du monde* (pp. 170–71). Moreover, this end state implies that the universe is contingent and finite in duration. But if that is the case, the universe had a beginning, which many authors identified with a state of minimum entropy. And that initial state required an outside cause, because it did not cause itself. That cause is therefore a creator, and that creator is God.

The core of Kragh’s book (chs. 4–5) describes the different versions of this argument (which he calls the entropic creation argument, or ECA) and the ways they were defended and criticized. This requires attending to a host of issues that give rise to large number of possibilities. Will the universe really end in a heat death, or will it be “recycled”? How did the introduction of a probabilistic interpretation of the second law affect the ECA? Do the laws of thermodynamics apply to the universe as a whole, or is it meaningless, as many critics of the ECA contend (pp. 143–52), to try to make them do so? Does the initial state of the universe, supposing it had one, require a divine cause?

As a Catholic who works in the history and philosophy of science, mainly late-nineteenth- and twentieth-century physics, chemistry, and cosmology, and on the relationship between contemporary natural science and Christian theology, I find Kragh’s book fascinating. (For German Catholics on the ECA, see pp. 74–93.) While he does not pretend to be exhaustive, Kraugh evidently has done a prodigious amount of research. *Entropic Creation* is very rich in details. However, I have a few reservations in recommending the book. One is that the cast of characters is so large in Kragh’s narrative that it is difficult to keep track of who said what and why. A “summary and overview” (pp. 213–20) is helpful, but the

task of understanding the range of positions is still daunting. Moreover, Kragh is a historian of science who describes the positions but does not evaluate them, either pro or con, except parenthetically. Another reservation is that the book costs \$115. For readers interested in a précis of Kragh's discussion without all the details, I suggest his essay "Cosmology and the Entropic Creation Argument" in *Historical Studies in the Physical and Biological Sciences* 37 (2007): 369–81.

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The Universe as Communion: Towards a Neo-Patristic Synthesis of Theology and Science. By Alexei Nesteruk. London: T&T Clark, 2008. xii + 286 pages. \$140.00.

When one looks over the current dialogue in theology-and-science, the insertion of patristics is a rare but welcome interaction. Alexei Nesteruk, a senior lecturer in mathematics at the University of Portsmouth and Deacon in the Russian Orthodox Church, is one of the few scholars doing work in this important exchange with patristics. In *The Universe as Communion*, Nesteruk presents an argument for the place of theology-and-science within the long-standing Orthodox church tradition. Far from bringing the Church Fathers into a current-day discussion with theology-and-science scholarship, he does the opposite, proposing that this recent scholarship is a part of the church's tradition and the work of the Holy Spirit. The title of this text is an allusion to John D. Zizioulas' text *Being as Communion: Studies in Personhood and the Church* (Crestwood, NY: St. Vladimir's Seminary Press, 1985), and, as is fitting, the author interacts with Zizioulas' material at various points in the book while also presenting his own vision of theology-and-science within an Orthodox ecclesiology.

Nesteruk puts forth the argument that just as Hellenism was the ethos from which Christianity arose in the time of the early church, theology-and-science arises out of this same Hellenistic ethos, as reclaimed by the phenomenology of the twentieth century. He states, "To uncover this hidden *telos* of Hellenistic antiquity in modern science and its philosophy one needs to employ . . . the philosophy which is capable of doing this. And this philosophy . . . is phenomenology" (p. 67). The emphasis of the book is exactly this same movement of the Holy Spirit through history, who has now brought phenomenology to the fore for such a time as this: the theology-and-science dialogue. For Nesteruk, "the dialogue between theology and science is not a dialogue at all: it is a drama of the human spirit" (p. 105). One understands his approach to the dialogue more clearly by placing it in an anthropological context.

In a related way, Nesteruk connects this dialogue with the eschatological aim of the church (p. 35), thus making ecclesiology a key component of the discussion. He later states this explicitly: "It is in this sense that the meaning of science in the perspective of the overall progress of the human spirit cannot be understood only on the grounds of the scientific and philosophical, that is, without a theological