tools needed to evaluate scientific claims. Her work explores many concepts needed to understand how scientific knowledge is produced, disseminated, and deployed and offers useful rules of thumb that readers can use to evaluate scientific findings, including a very helpful discussion of the role of probability and statistics in scientific model building, forecasting, and evaluation. However, readers are likely to lose track of Dean's argument amidst the book's rambling discourse, a problem exacerbated by poor editing. In some places sentences unconnected to the topic at hand seemingly appear out of nowhere and in others a discussion is dropped in midthought, only to be picked up pages later with nary a reference to anything said in between. Readers are also likely to be confused by how often Dean's own judgements ignore her own guidelines for responsibly assessing scientific findings. For instance, her treatment of food and health largely eschews careful analysis in favor of extolling the virtues of organic agriculture and demonizing "Big Ag." At one point she even stoops to encouraging readers to avoid foods for which you would "need a degree in chemistry to know what you are eating."

Dean's portrayal of science is also at times misleading. She understandably focuses on science of interest to medical, environmental, and public policy concerns, much of which can be difficult to study or relies on speculative modelling. This, along with Dean's tendency to focus on problems in science rather than its ordinary operations, means that Dean effectively leaves readers with the impression that science is a more tepid, self-contradictory, and error-prone enterprise than it actually is. In short, the science she enjoins her readers to make sense of is far too easy to dismiss. This makes it hard to take her seriously when she alternately portrays science as unsure and encourages readers to accept the reality of global warming or scientific origin accounts on the authority of a supposed consensus.

Dean's reliance on the authority of luminaries rather than argumentation also limits the usefulness of the work as a resource for those who wish to understand the actual content of science and society issues or engage in the sort of thinking needed to develop their own position. This is well illustrated by her treatment of science and religion. Dean's account focuses narrowly on public debates over origins science and is at its best when exploring the debate's American educational context and the Discovery Institute's antievolutionary efforts. In contrast, the case for consensus origins science and its incompatibility with "literal" creation accounts that address "our place in the universe" are largely addressed via assertions based on the authority of mainline science and religion luminaries. Nowhere does she seriously explore the content of either evolutionary science or antievolutionist objections to it. Thus while readers of *PSCF* will likely find themselves in sympathy with her conclusion, that it is possible to believe in both science and a God "to whom one can pray," readers who do not agree with her at the outset will likely be left unpersuaded of either the reliability of evolutionary accounts or their compatibility with a coherent Christian theology.

It is also worth noting that while I enjoyed hearing Dean's insights into the role of special interests in the shaping of public perceptions and policy, her treatment of familiar topics often seemed sloppy, inaccurate, and misleading. The most notable example involved her confusion of ground level ozone with chlorofluorocarbons and smog, although it is also evident in her shallow account of scientific rationality based on an overly simplistic account of Popperian falsifiability and her sloppy use of ambiguous examples when summarizing Daniel Kahneman's *Thinking, Fast and Slow*. This left me wondering whether Dean accurately portrayed topics I knew less about.

Nevertheless *Making Sense of Science* can still be commended as one of the few popular-level books that seek to address the role of cognitive bias, modeling and statistics, and science's social and professional structure in the making of scientific claims. Dean is also at her best when discussing the public context of scientific issues; readers of *Making Sense of Science* will gain an appreciation for how science impacts American life. Dean also does well to introduce readers to the concepts and precedents that guide regulators, jurists, and others who use scientific findings in decision making, thus cautioning them about the role of politics and special interest-driven marketing campaigns in sidestepping the implications of unwelcome scientific findings. Yet in its treatment of scientific issues, *Making Sense of Science* does better at spurring further study than offering a clear and reliable guide.

Reviewed by Stephen Contakes, Associate Professor of Chemistry, Westmont College, Santa Barbara, CA 93108.

ASTROPHYSICS AND CREATION: Perceiving the Universe through Science and Participation by Arnold Benz. New York: Crossroad, 2017. 144 pages. Hardcover; $13.56. ISBN: 9780824522131.

In this short work, Benz takes the reader on a tour of the universe while also trying to make sense of religious experience. He does the first very well. But in the process of building his philosophy, he ends up

throwing out the Christian God, whom he replaces with an undefinable force that is known through "participatory perception."

The length of this book belies the breadth of its content. It is packed full of information and ideas spread over 12 chapters and divided into 3 parts. The first part is a description of the universe, focusing primarily on star and planet formation, entitled "Amazing Formation." Here Benz shows his ability to simplify complex science to a popular audience. Molecular clouds, accretion disks, planets, stars, black holes, and the big bang all are described without technical language. In fact, as part of the translation into English, he even removed SI units. For example, a density measurement is described as atoms per gallon instead of per cubic meter or centimeter. It is impressive and approachable for someone without background in astronomy.

The second part is entitled "Dissolution and Horror" and deals with topics such as stellar evolution, supernovae, and extinction causing meteors. Again, the science is accessible and engaging. Here Benz begins to build his thesis by pointing out that the formation of stars and planets required the destruction of previous generations of stars through supernovae, and biological evolution was shaped by meteors (among other destructive processes).

In this section, he also builds his philosophy of reality and science in chapters 7 and 8. He argues that reality perceived through science is on a different plane than religious "perceptions." This is not just observing reality through different lenses, but observing different levels of reality. For Benz, the overlap comes through "participatory perceptions." An example he provides is art. When observing a painting, colors can be defined scientifically with light wavelength or frequency. The chemical composition of the paint can be studied and is different depending on whether the artist used watercolors or oils. But an individual can also be moved by art at an emotional level and that emotional engagement is not quantifiable. Both the scientific observations and the emotional perceptions are real, but they reflect different kinds of reality.

However, science and other "perceptions" are interpreted; so in chapter eight Benz describes three types of interpretations. The first is "explaining and modeling." Scientists interpret this way when they use the scientific method and then publish their results. "Comprehending" is nonmathematical and might be best modeled by what Benz himself did in chapters 1–6. Finally, "construing" is what scientists do "with friends in the evening over a glass of wine at the fireplace," or, as reflected in the last four chapters, what scientists "write in popular science books." I see this chapter as the keystone that holds the rest of the book together. It is an interesting way of thinking about interpretation, though those in the social sciences and related areas of research would object to his claim that explaining and modeling require mathematical equations.

From here, Benz goes downhill rapidly in part three, "Interpreting the Universe as a Creation." Since he thinks that God cannot be seen in science, he is left with "construing" as the only remaining avenue to God. He is obviously fully engaged with existentialism. He rightly rejects the deistic "watchmaker" god and the nonoverlapping magisteria model of faith/science integration. But in the process he redefines God and Creation to be unrecognizable to traditional Christian theism.

First, he defines creation as the recycling of new out of old. As new stars form out of molecular clouds that are the remnants of previous stars' supernovae, so Jesus's resurrection was a new hope and new life out of death and despair. When Benz speaks of creation, he does not refer to God's making the universe out of nothing (*ex nihilo*). Rather, old material must be present and creation is better understood as recycling (*creatio continua*). It should be noted that Benz is agnostic about the origin of the big bang. He repeatedly says that we cannot know anything about its origin; he is happy to leave God out of it. This was surprising, as most Christian scientists argue that the big bang fits the biblical testimony of creation *ex nihilo*. Benz argues that his conception of creation as a regenerative process is how it would have been understood by ancient readers, but provides no support for this claim.

Secondly, Benz's concept of God appears to be something more akin to a transcendent force. On several occasions he opposes the idea that God is a person. He claims that conceiving or describing God as a person is simply metaphorical. Obviously, this is a significant departure from orthodox Christian belief. In what sense is Jesus God if God is not a person? Benz argues that characteristics of personality were ascribed to God by the writers of scripture as an attempt to make sense of their experiences. But traditional Christian theology argues that our personhood was given to us as part of being made in God's image, not the other way around. Again, Benz provides no support for this concept of God except to claim that the traditional view is "much criticized among physicists." Criticism by physicists is hardly proof or reason to abandon centuries of confessional Christianity. To support his claim that the traditional

view is "much criticized," Benz provides only one reference, that of Albert Einstein. Statements such as "God cannot be experienced objectively" raise questions about the incarnation. One of the unique aspects of Christianity that apologists often cite is that Christianity and the Bible make historical claims. Jesus, the God-man, coequal with the Father, told his disciples to make physical observations to confirm his resurrection (Luke 24:39; John 20:27).

In sum, there is one major assumption that Benz makes as outlined in the preface to the English edition. This is that "God cannot be evidenced by scientific methods." In defense of this claim, Benz uncritically cites Hume, including Hume's thesis that miracles are impossible, without ever acknowledging the many Christian responses. Since Benz cites the resurrection as an example of his idea of creation, I wonder if he considers it to be a literal, physical, and observable miracle. Those who disagree with Benz's assumption will remain unconvinced. But oddly enough, Benz says there is at least one condition in which he would recognize scientific evidence for God: if the laws of physics were one way on Earth, or in our region of the universe, while different elsewhere. I found this strange but keeping in line with his rejection of traditional Christian thought. Christianity has offered a framework in which science can flourish by understanding God as immutable and constant. The laws of nature are universal because they reflect God's attributes. This offers a response to the problem of induction. But Benz rightly acknowledges induction as a piece of the scientific process. The conclusion we are left with seems to be that only a God whose laws are not universal would be detectable by science, which depends on the universality of natural laws!

Perhaps Benz avoided the dialogue and debate that might make his philosophy more robust because the book is intended for a popular audience. The science content is engaging and accessible. But I wonder if the average person looking for an accessible review of astrophysics wants a popular work on existentialism. The Christian wanting a perspective on faith and science will find the faith dimension sorely lacking.

Reviewed by Tyler Scott, Department of Physics, Northwestern College, Orange City, IA 51041.

ON FAITH AND SCIENCE by Edward J. Larson and Michael Ruse. New Haven, CT: Yale University Press, 2017. 298 pages. Hardcover; $30.00. ISBN: 9780300216172.

Two of the most distinguished, well-known historians and philosophers of science collaborate in another recounting of the historical encounter between science and faith. Much has been written on this topic and one might wonder what new insights there could possibly be. Yet, these skilled authors shed more light on the interface between these two paradigms.

Ed Larson is professor of history and Hugh and Hazel Darling Chair in Law at Pepperdine University. His most acclaimed work is the book *Summer for the Gods: The Scopes Trial and America's Continuing Debate over Science and Religion*, for which he received the Pulitzer Prize for History in 1998. He has written nine other books, several of which deal with evolution and creation, and has made frequent appearances in public forums to discuss faith and science.

Michael Ruse is Lucyle T. Werkmeister Professor and director of the History and Philosophy of Science program at Florida State University. He taught at the University of Guelph in Ontario for 35 years and has been at Florida State since 2000. Though a self-described atheist not subscribing to Christian faith, Ruse argues that Christianity and evolution are compatible and he disagrees sharply with the harsh arguments of the so-called "new atheists." He has published numerous books and articles and participated in countless public events to make his case.

Larson and Ruse alternate as lead authors of the nine chapters, blending the views from their expertise in history and philosophy, respectively. They do not claim to be breaking new ground or proposing major new insights. Rather, they want to show how the science-faith interface cannot be described in a straightforward set of models, such as the conflict model or the compatibility model. They

> favor what might be called a "coexistence" approach, which views religion and science as two big messy and sometimes internally inconsistent categories of human perception and understanding that coexist in the same place and time, sometimes in a complementary or conflicting relationship but most often in a complex one, with both categories currently growing in influence and authority in many regions. (p. 12)

The conflict model exists and thrives as well as the complementary approach, with a wide range of complex interactions in between.

The first two chapters provide a high-level overview of the trajectory of science, particularly astronomy and physics, from ancient days until now. Ancient metaphors depicted the universe as an organism largely controlled by gods or vital forces. Then Galileo, Kepler, Newton, and others helped to transform the metaphor from that of an organism to that of a machine. The mechanistic universe took hold, incorporating even biology, thanks to Charles