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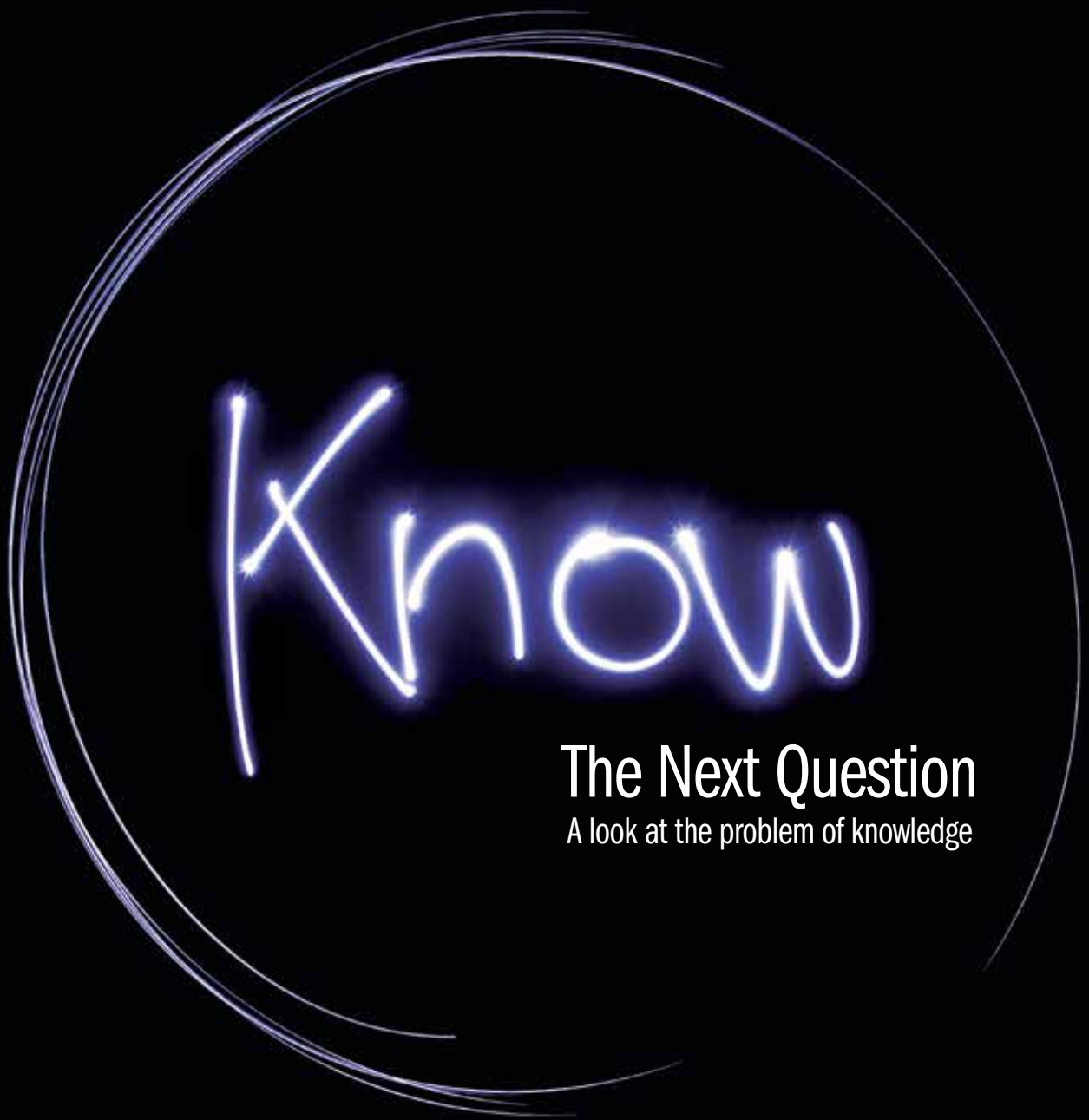
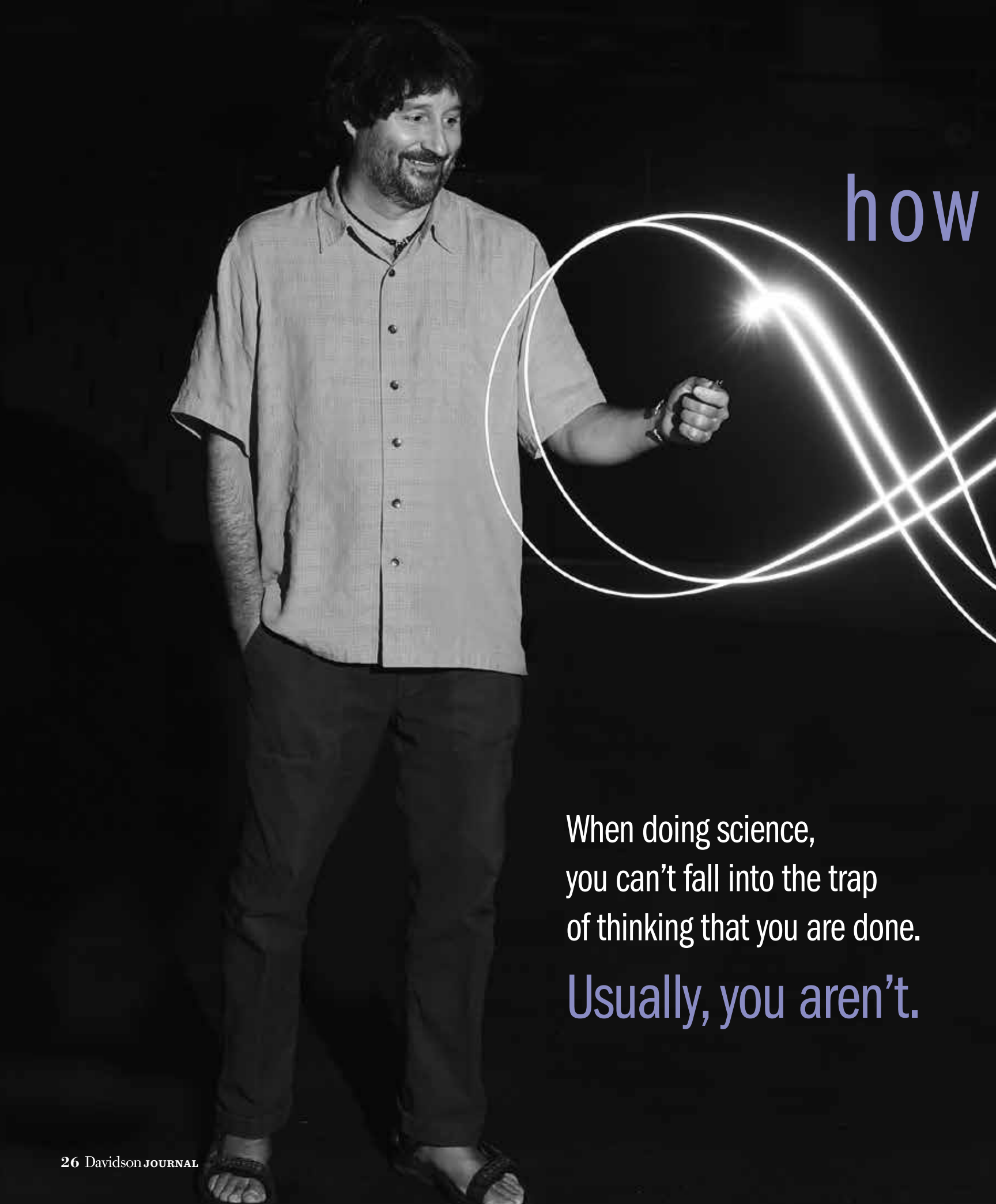


The Next Question

A look at the problem of knowledge

Toleration thought and coming home: Profile of a legal scholar


how
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Usually, you aren't.

do you know?

By Robert Abare

In light of demands for ever-simpler answers to complicated questions, Davidson professors tackle the problem of knowledge. Does it really exist? What are the dangers of accepting 'facts' or 'truths'? Perhaps what we know, their conversation reveals, is not as important as how we know it.

IN 2011, a team of astronomers led by John Webb of the University of New South Wales, Australia, used some of the most powerful telescopes on Earth to peer into the deepest reaches of space. The faint light they observed had traveled 10 billion years to get here. So, by looking into their telescopes, Webb and his team were looking back to the earliest chapters of our universe—near the beginning of time itself.

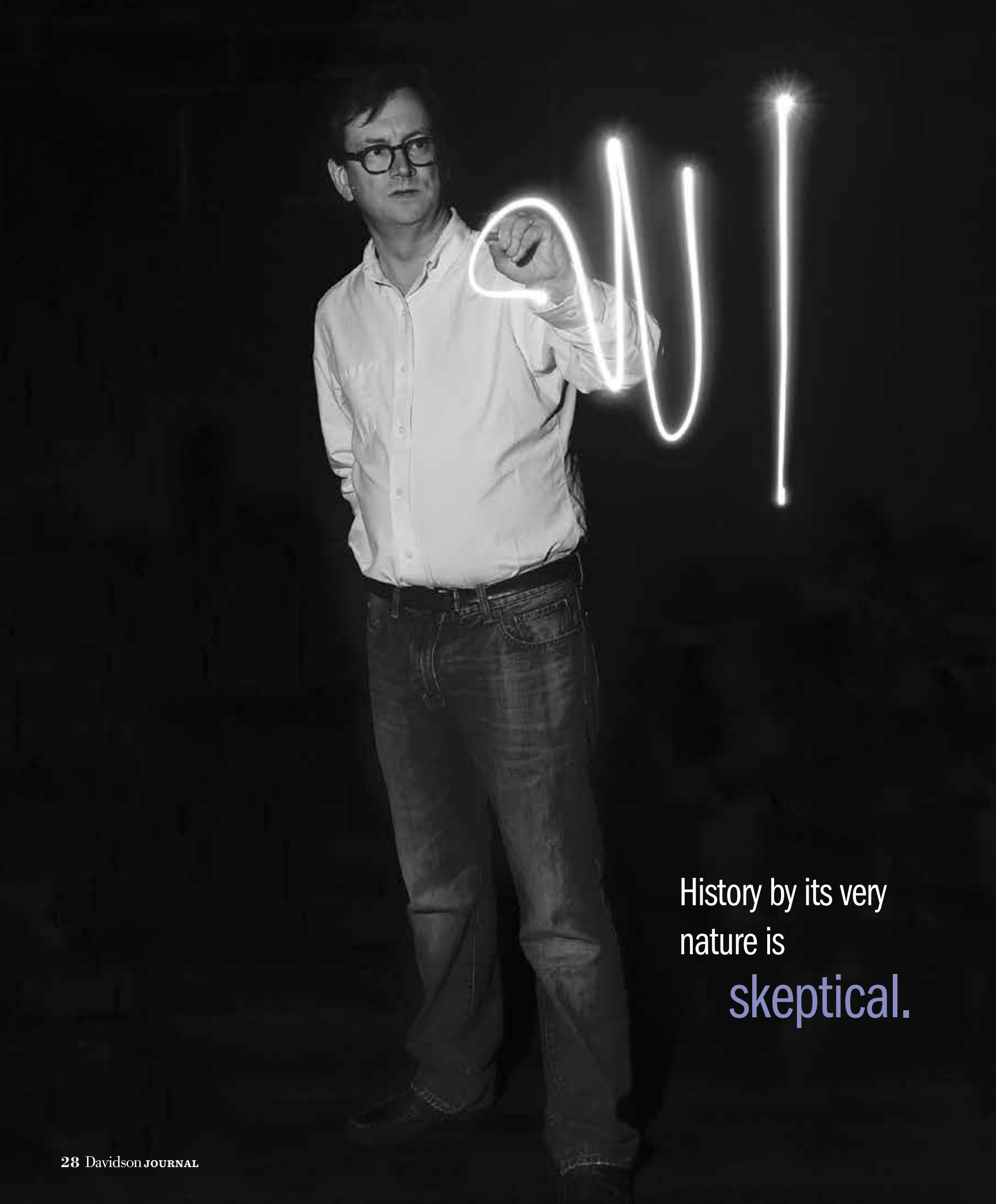
The researchers sought an answer to a radical question. What if the fundamental physical constants of our universe, which scholars have perfected and relied on for hundreds of years, have not always been, well, constant? What if the laws of physics were different, say…10 billion years ago?

Webb and his team investigated these questions by looking for variations in the "fine-structure constant." Denoted by the Greek letter alpha, (perhaps a hint to its significance), the fine-structure constant is a fundamental physical constant that is essential to spectroscopy, or the study of interactions between matter and electromagnetic energy.

The motivating principle behind Webb's study is as revolutionary as it is controversial. Critics could call it pointless, or a wildly creative attempt to learn more about our universe. Davidson's Professor of Physics Tim Gfroerer says it points to the importance of skepticism in scientific discovery.

"The whole idea of science is built upon the idea that understanding is always subject to change," he says. "And it does change."

The possibility of an inconstant constant rattles more than the foundations of science, but also history, philosophy and perhaps the very notion of knowledge itself. It reveals how complete understanding strangely precludes yet more understanding. It raises the question: can you—or should you—really be sure of anything? How do you know?


History by its very
nature is
skeptical.

Tiny Imperfections, Major Consequences

With advanced degrees in both physics and electrical engineering, Gfroerer focuses his research on the varying abilities of semiconductors, like silicon, to conduct electricity. This summer, Gfroerer mentored rising senior Ben Stroup '16 as he completed a research project through a grant from the Faculty Study and Research Committee. Stroup studied the properties of a blue light emitting diode (LED), by subjecting it to varying levels of temperature and electrical current, and then using a camera to observe the changes in the light it emits.

"At low temperatures and at low currents, we found that the light emitted by the LED is less homogeneous," says Gfroerer. Or, as he translates for the layman, "It looks sparkly."

Gfroerer says he and Stroup will attempt to make sense of this phenomenon by developing mathematical models. "I like to think of the science that we do as measuring new things, then coming up with explanations, and then trying to validate those explanations," says Gfroerer. "But I never have complete confidence that what we've done is accurate."

Gfroerer says a dubious attitude is required by scientific work. The result of any study may be called into question by another—even if both studies are set up to be essentially the same. "In terms of semiconductors, two different scientists may analyze the properties of seemingly identical samples of silicon, yet they may arrive at completely different results."

This confounding outcome arises from miniscule differences present in semiconductor samples. "Even if one atom out of every billion is different or out of place, that creates a measurable effect on the behavior of that sample," says Gfroerer.

In light of the puzzling, sometimes aggravating, nature of science to avoid comfortable conclusions, Gfroerer recalls one of the most embarrassing quotes ever spoken by a scientist, declared by Lord Kelvin in 1900: "There is nothing new to be discovered in physics now. All that remains is more and more precise measurement."

The great irony of this statement, of course, is that many of the most important discoveries in physics came in the decades after Kelvin's prediction. Gfroerer says, "When doing science, you can't fall into the trap of thinking that you are done. Usually, you aren't."

The Slippery Slopes of History

History clearly shows that scientific understanding continually improves, becoming ever more complex, and sometimes changing direction entirely. But perhaps history itself can provide some measure of solid footing when searching for certainty (which one might be doing after all this mind-boggling exercise). After all, can't we all agree, "You can't change the past?"

Think again.

History is by no means fixed, as James B. Duke Professor of International Studies and Professor of History Jonathan Berkey explains. In fact, Berkey invokes an open-minded approach to history strikingly akin to Gfroerer's suspicious approach to science.

"History by its very nature is skeptical," Berkey says. "Historians have long been aware that texts are 'slippery.' They can mean different things in different contexts, and the people who produce them can intend them to mean one thing or another."

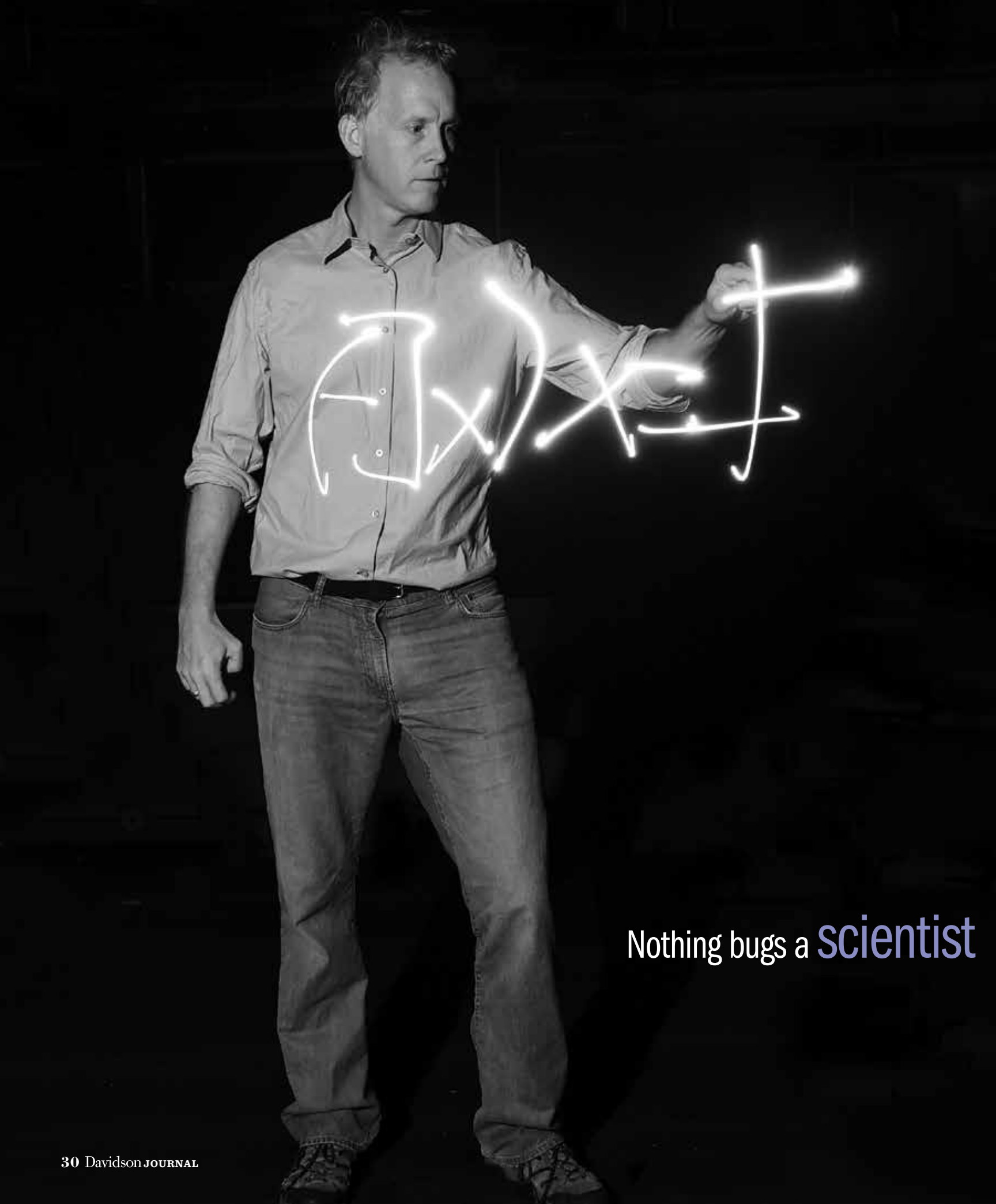
Berkey, who specializes in Islamic History, says his field is filled with problems and debates that arise from this textual 'slipperiness.' He explains that Islamic sources yield certain narratives about what happened during Mohamed's life and immediately after his death. "Historians are aware of problems with these sources," says Berkey. "For example, essentially no Muslim narrative sources survive for virtually 150 years after Mohamed's death."

These problems raise questions. "To what degree can one trust the narratives that these texts tell?" Berkey asks. "Do these texts reflect 'what really happened,' or just the political and theological interests of the people who wrote them many years after the fact?"

Berkey explains that healthy historical debate has only recently led to a better understanding of Islam's earliest years. "We are beginning to see how Islam in its early decades was more closely related to Judaism and Christianity than many Muslims would attest. Some have argued that, for the first two generations, Islam was not its own religion but a monotheistic variant of Judaism."

Berkey also says it's a mistake to think of history as a sequential presentation of facts. "I think most historians would agree with the proposition that you cannot know the past," he says. "All we have are people's memories and narratives. All these are, essentially, are stories, and stories can be told in different ways."

"But historians can also agree that some stories are better than others," he adds. "Some reconstructions of the past are more likely to be accurate. It's over the degree of accuracy that we argue and debate."



Nothing bugs a scientist

What's in a Worldview?

Considering his smug emphasis on "more and more precise measurement," perhaps Lord Kelvin would be pleased by Berkey's assessment of the practice of history. Indeed, it seems both history and science share a reliance on testing, evidence, and a healthy dose of skepticism in order to support or discredit varying theories, and thus build stronger bodies of knowledge. One might conclude that everything we know can be tested and verified—that our modern understanding of the world rests on the foundation of the scientific method.

Yet such a clean, scientific resolution withers under the weight of untidy, philosophical questions. After all, nothing bugs a scientist quite like a philosopher.

"There are any number of deep questions that science doesn't know what to do with," chimes Associate Professor of Philosophy Paul Studtmann. "Anyone who claims that somehow our knowledge simply consists of science plus math and logic must confront topics that don't easily conform to scientific testing, like ethics and morality."

Studtmann, who specializes in the history of philosophy, explains that common understanding has, over time, been characterized by a "creeping empiricism," or a gradually increased reliance on science-like testing and observation.

In philosophy, empiricism is the theory that all knowledge derives from human sense experience, a view that was pioneered in the modern period by philosophers John Locke, George Berkeley and David Hume.

Studtmann explains how a reliance on empirical thinking may lead to intellectual roadblocks.

"Suppose I make the claim that any proposition that is not empirically verifiable is meaningless," he says (while mentioning that many philosophers, most famously the logical positivists, have held this view, or one like it). "But, if it turns out that this claim is not itself verifiable, I can conclude that the claim itself is meaningless. This is a fundamental problem that empiricists continue to face."

Beside the threat of self-refutation, empiricists also face the problem of morality. "If I know anything, I know that it's wrong to torture children," Studtmann states, providing an example of an unspoken moral 'truth.' "But how do I know this? Is injustice only something I perceive? If not, then a consistent empiricist should deny that it exists."

Philosophers continue to grapple with these tensions between a scientific worldview and a worldview populated with objective value and meaning. "Scholars have invented any number of "isms" in an attempt to forge a connection between empirical knowledge and humanity's inexplicably shared sense of moral behavior," says Studtmann.

"Ultimately, these deep philosophical questions infringe on many of our basic beliefs, and they remain unsettled to this day," he adds. "Maybe they will always be unsettled. Or maybe someone will finally devise a way forward."

Never Rest Assured

After tossing so many of our shared presumptions into the intellectual blender, a search for something solid—something absolutely true—seems refreshing. A cursory search may lead, paradoxically, to the quintessentially intangible: light. The speed of light (3×10^8 meters per second) is perhaps the fundamental law of our universe, and which, according to scientific consensus, acts as a universal "speed limit" for the transmittal of useful information in our universe.

Light, so it seems, cannot be surpassed.

Not so fast. Remember John Webb, and his wild idea to peer deep into space, and thus determine if the constants of our universe have always been the same?

Remarkably, Webb's data collected from the Keck telescope in Hawaii hinted that the fine-structure constant was once, in fact, smaller at a distant place and time. More striking still, the data Webb and his team recorded from the Very Large Telescope (VLT) in Chile revealed the opposite: that the fine structure constant was once larger than it is at present.

Because the Keck telescope points into the northern hemisphere, while the VLT looks south, the results suggest that the fine-structure constant, and perhaps many fundamental physical constants—like the speed of light—vary in different places and eras of our universe. In other words, perhaps our most basic truths are only true here and now, but not beyond.

Then again, the results of Webb's study have since been disputed by more recent research, which corrected for subtle differences in telescope technology and other factors. But, then again (again), these studies don't claim definitive certainty, but rather a need for better tools and accuracy to investigate the exciting potential of Webb's findings.

Varying though their disciplines may be, Gfroerer, Berkey and Studtmann reveal a similar cycle of skepticism and evaluation in their thoughts and scholarly work. They demonstrate the necessity of radical thinking in the quest for discovery, and that the best scholars search not only for answers, but also for the next question.

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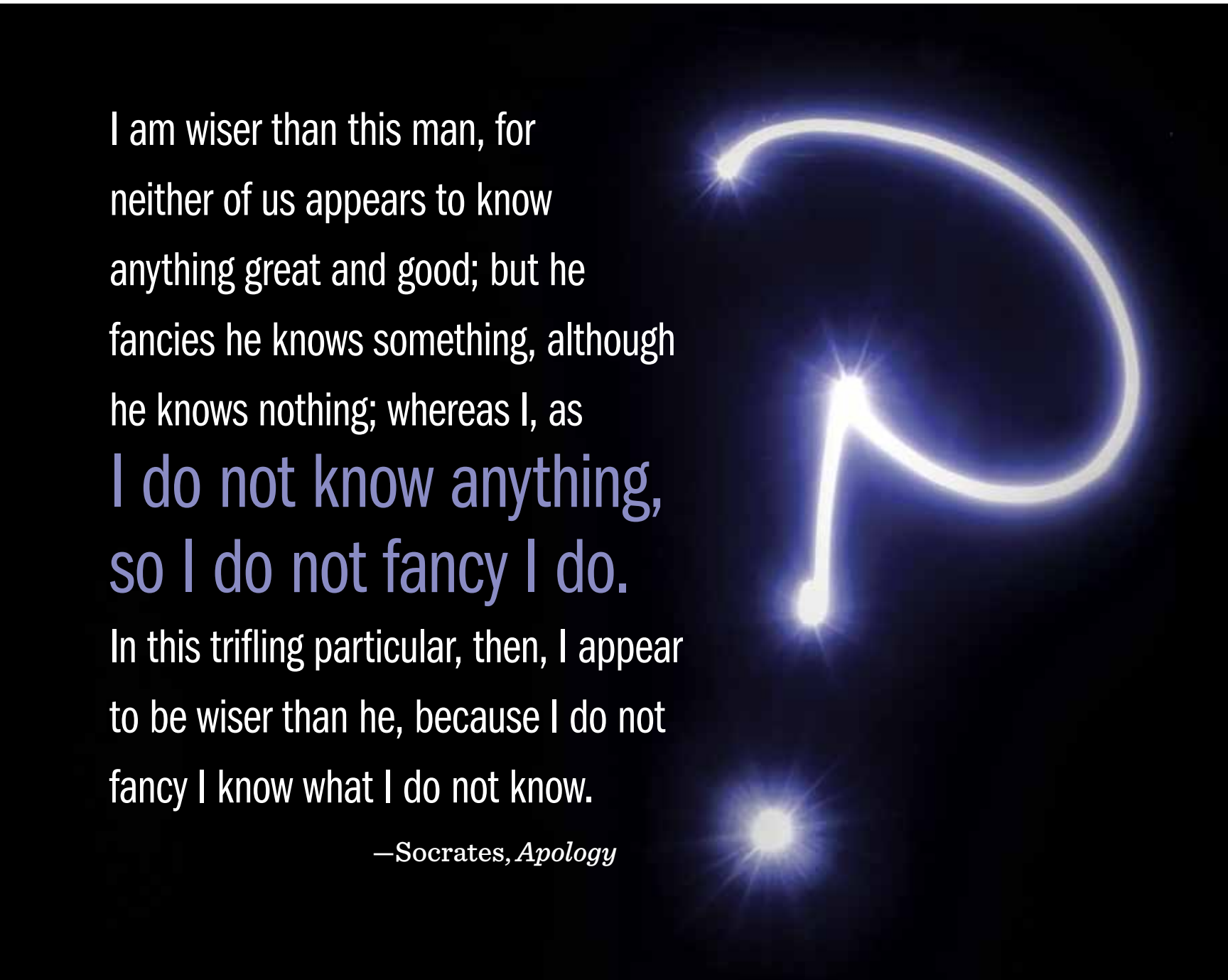

I am wiser than this man, for neither of us appears to know anything great and good; but he fancies he knows something, although he knows nothing; whereas I, as

I do not know anything, so I do not fancy I do.

In this trifling particular, then, I appear to be wiser than he, because I do not fancy I know what I do not know.

—Socrates, *Apology*