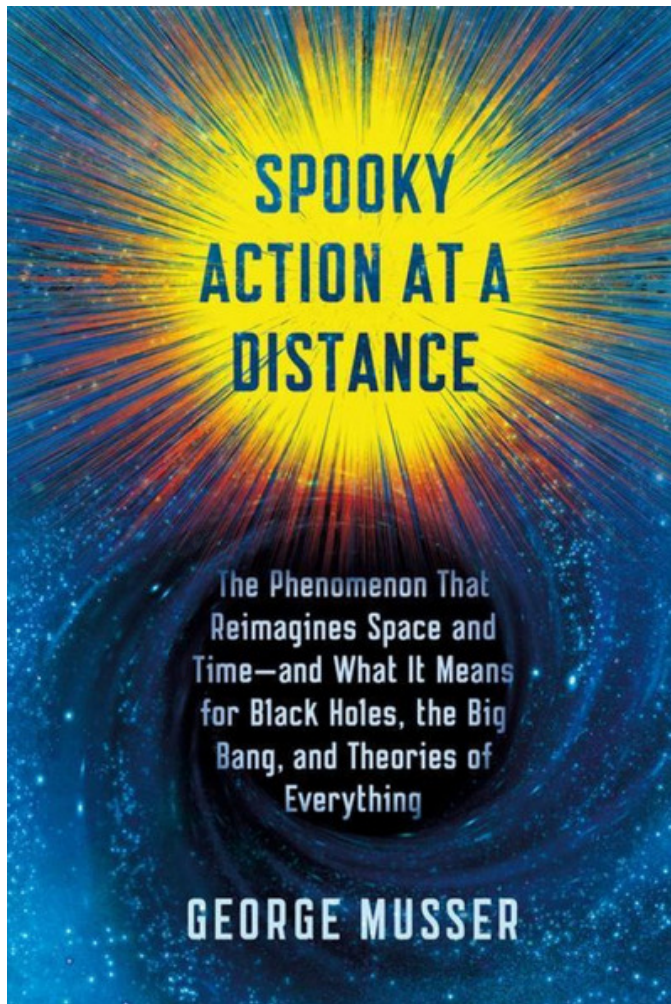


'Spooky' aims to solve mystery

Posted: Sunday, December 6, 2015

"Spooky Action at a Distance: The Phenomenon That Reimagines Space and Time – And What It Means for Black Holes, the Big Bang, and Theories of Everything," by George Musser. New York: Scientific American (Farrar, Straus and Giroux), 2015, 304 pages, \$27.



“Physics is not like other sciences,” George Musser explains in “The Origins of Nonlocality,” the second chapter in “Spooky Action at a Distance: The Phenomenon That Reimagines Space and Time – And What It Means for Black Holes, the Big Bang, and Theories of Everything,” his new book about one of the strangest occurrences predicted by quantum mechanics. “If you ask geologists, biologists or astronomers to define their subject, they can point to rocks, things that slither or twinkles in the night sky. Physicists, however, start pointing at everything around them; they’re not particular. You are as apt to see them studying the origami of biological proteins and the yo-yoing of financial markets as the collision of tiny particles.”

“Their discipline is defined less by its subject matter than by its goals,” he adds. “In whatever they focus on, physicists seek the simplicity in complexity and the unity in diversity. Like philosophers, their intellectual siblings, they are driven by the conviction that the universe is within the human power to understand and that if you look beneath its variety and intricacy, you will find comprehensible rules.”

My interest in Musser’s attempt to explain something that has eluded previous efforts at dissection was spurred by a conversation I had this year with my son, who had read a Huffington Post article, “Scientists Prove That a Particle Can be in Two Places at Once, Everything Gets Weird” (March 31) by Thomas Tamblyn. In the intervening months, we have been engaged in a sporadic yet fairly consistent discussion about the potential implications of this common sense-defying revelation.

In a generic sense, the term “locality” refers to the idea that everything exists at a specific place and at a specific time. This is how we understand the world, and it seems to be a fundamental principle defining the way everything works. Most of us would argue vehemently that objects simply cannot occupy two or more places at the same time.

“The world we experience possesses all the qualities of locality,” Musser explains in “Einstein’s Castle in the Air,” one of my favorite chapters. “And yet quantum mechanics and other branches of physics now suggest that, at a deeper level, there may be no such thing as place and no such thing as distance. Physics experiments can bind the fate of two particles together, so that they behave like a pair of magic coins: if you flip them, each will land on heads or tails – but always on the same side as its partner. They act in a coordinated way even though no force passes through the space between them. Those particles might zip off to opposite sides of the universe, and still they act in unison. These particles violate locality. They transcend space.”

The other concept central to “Spooky Action” is the notion of entanglement, or the idea that a connection can seemingly exist between two particles without any discernible structure or force serving as a conduit for that connection. If, for example, I was on the dark side of the moon while my son was here in Bowling Green and he was able to communicate with me by simply thinking a particular thought, and if I became instantly aware of the thought at the moment he thought it, you might say we were somehow “entangled.” Contemporary science can provide no plausible explanation for why that might occur, although the mathematical equations underlying the quantum realm certainly suggest that it is possible.

“Entanglement is the best known of several types of nonlocality that modern physicists have observed, and the one that spooked Einstein,” Musser writes in “The Many Varieties of Nonlocality,” the first real chapter of the book following the introduction. “The word ‘entanglement’ has connotations similar to a romantic entanglement: a special and potentially troublesome relationship. Two particles that are entangled with each other are not literally intertwined, like balls of yarn; rather, they have a peculiar bond that transcends space.”

Musser is a Knight Science Journalism Fellow at the Massachusetts Institute of Technology and a contributing editor for *Scientific American* magazine. He is the recipient of the 2011 Science Writing Award from the American Institute of Physics and the 2010 Jonathan Eberhart Planetary Sciences Journalism Award from the American Astronomical Society. The author of several influential scholarly articles, Musser completed his undergraduate degree in electrical engineering and mathematics at Brown University and his graduate work was in planetary science at Cornell University, where he was a National Science Foundation Graduate Fellow. His previous books include “The Complete Idiot’s Guide to String Theory.”

“Spooky Action” is extensively researched, with 32 pages of source notes and a 28-page bibliography at the end of the introduction, six chapters and conclusion that comprise the main text. The writing style is engaging and crisp; Musser is able to articulate his thesis in an authoritative and fairly straightforward manner. Those well versed in the basic science on which most of the narrative is built will no doubt be able to digest his arguments in a more substantive context. At the same time, readers whose interest in the subject matter is more grounded in science fiction than empirical evidence will still find much of what Musser has to say fascinating and relevant.

Finally, the book is as much a history lesson as it is an effort to solve one of the monumental mysteries in science. As Musser describes the various experimental attempts to verify the phenomenon and its underlying mechanism, the story he weaves sheds further light on the political landscape that has always characterized the scientific community. At the end of the day, however, we still do not understand how nonlocality and entanglement occur, nor do we fully appreciate the profound implications of these phenomena. Personally, I believe the eventual explanation will involve a spiritual dimension. I recommend this one highly.

— Reviewed by Aaron W. Hughey, Department of Counseling and Student Affairs, Western Kentucky University.