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**Questionable Questions in Analysis and Synthesis**

In "Analysis and Synthesis IV: Limits and Supplements" (*Physics Today*, January 2004, page 10), Frank Wilczek describes the question "Why is the Solar System as it is?" as "discredited." But to do so is to discredit the many fields of physics—including geophysics and planetology—that dare to address phenomena that are not "universal" or "clean." Although our own solar system has a history that is perhaps accidental and idiosyncratic, it is nonetheless the "limited slice of the world" in which all of us live. A deeper understanding of the system's admittedly messy history is essential if we are to address intelligently such issues as global change and resource management. And on a philosophical level, knowing the particular happenstances of our history is as important to our humanity as knowing the story of one's own family or culture. To study that deep history is no less creditable or scientific than to seek transcendent explanations for worlds to which we have no access.

There are so many messy, intellectually challenging questions to which the legions of brilliant, un- and underemployed physicists might fruitfully turn their thoughts. I am saddened to see such lines of inquiry devalued.

**Marcia G. Bjørnerud**  
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Frank Wilczek says that the question of precisely when a radioactive nucleus will decay has been "rendered questionable by quantum mechanics." Apparently, most physicists take that for granted. However, using quantum mechanics as the reason we physicists can't solve complex subatomic problems is simply too convenient. We can just as easily think of classical, deterministic problems that exhibit the same statistical characteristics as subatomic problems do. As an example, I offer a *gedanken* experiment: the radioactive wiffle ball.

Take a baseball-sized wiffle ball, place a BB inside, and shake it vigorously. After a time, the excited wiffle ball will emit a BB and thus become stable. Repeat the experiment thousands of times, and you will observe that radioactive wiffle balls have a half-life. Should an outside observer assume that the internal processes of the wiffle ball are random? No, what we have is a deterministic problem with an infinite number of initial conditions. The behavior is describable only statistically, but is not due to random processes. Statistical behavior at any level is not proof of randomness in the physical world.

**Joe Lacetera**  
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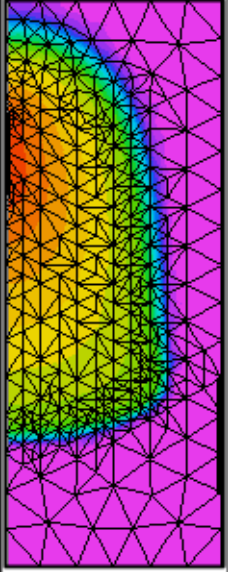


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**Wilczek replies:** Each correspondent has a valid point. I enthusiastically agree with Marcia Bjørnerud: The nonuniversal problems that arise in describing our specific place in the world are not only valid but often fascinating and important. I was building toward this major point in the entire series, and it was emphasized explicitly in the final sentence: "Such necessary concessions to reality compromise the formal purity of the ideal of understanding the world by analysis and synthesis, but in compensation, they allow its spirit much wider scope."

I also agree with Joe Lacetera, though more reservedly. The idea that the statistical aspect of quantum theory might reflect our incomplete comprehension of an underlying deterministic theory has had some extremely eminent champions, from Albert Einstein at the beginning to Gerardus 't Hooft today. It is a difficult program, however, since the success of quantum theory is broad and deep, especially in the atomic and subatomic realms. I'd be more optimistic about finding surprises in the recent, promising, but relatively poorly tested application of quantum theory to cosmology, as I mentioned in the column: "We can test the hypothesized quantum origin of primordial fluctuations by checking whether those fluctuations satisfy statistical criteria for true randomness."

**Frank Wilczek**  
Massachusetts Institute of Technology  
Cambridge

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