Book Review

The Second Kind of Impossible: The Extraordinary Quest for a New Form of Matter

By Paul J. Steinhardt

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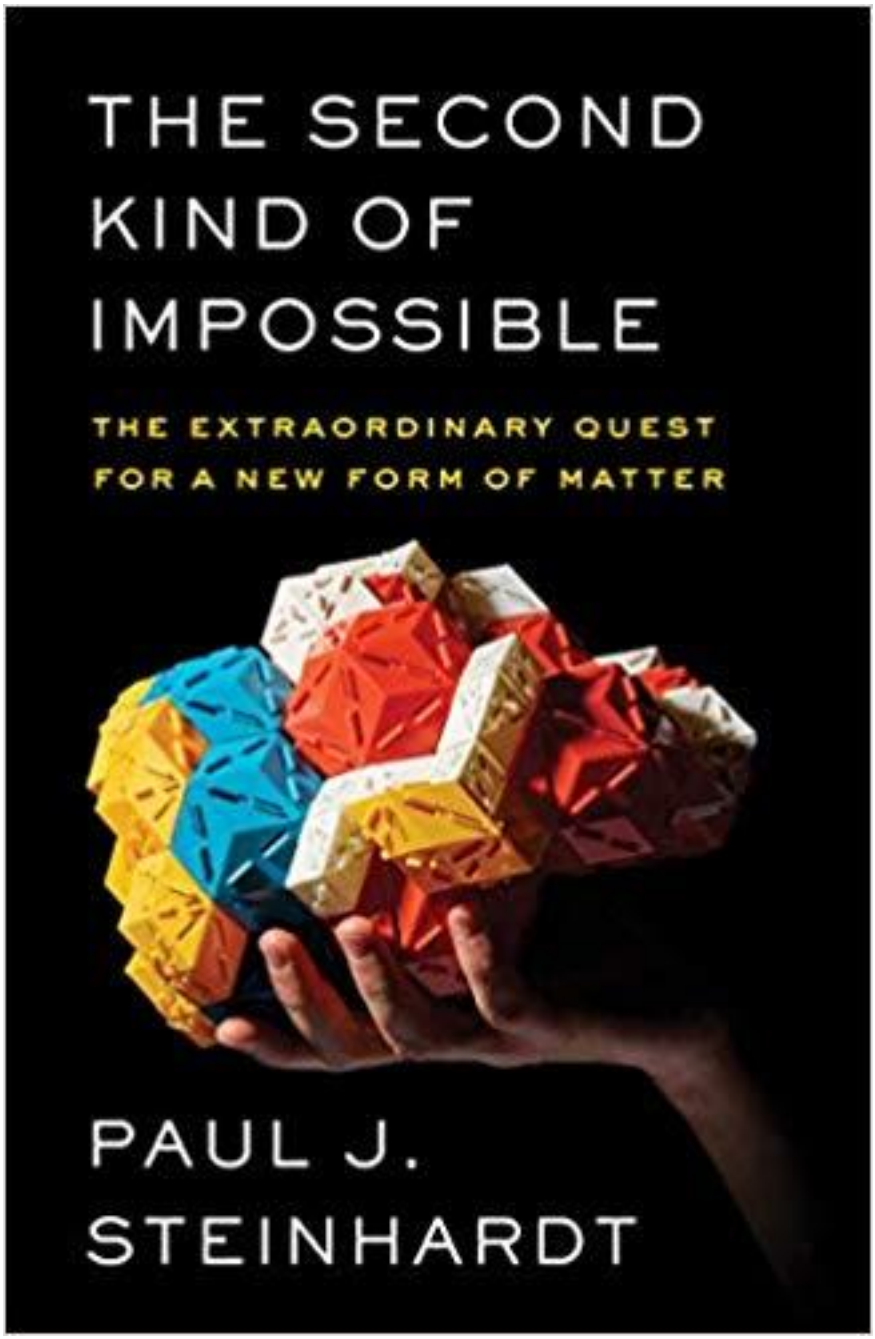

The Second Kind of Impossible starts with Paul J. Steinhardt's 2011 expedition to the Kamchatka Peninsula in Russia. Being swarmed by mosquitoes and traipsing through muck while conducting research out in the field sounds like a typical day in the life of a wildlife biologist—not a renowned Princeton physics professor such as Steinhardt. Already, by page 2, he has the reader hooked—what on Earth was he doing there, and what was he looking for?

Steinhardt then hits rewind, taking his reader back 35 years to a presentation he gave at his alma mater, Caltech. He and his colleague, Dov Levine, had theoretically invented a new type of matter. Richard Feynman, one of Steinhardt's former professors and a member of the audience, boomed that the theory was "impossible."

Here, Steinhardt takes another step back, explaining his personal history with Feynman as a professor, and his realization that "impossible," when used by Feynman, did not necessarily mean "unachievable" or "ridiculous"—sometimes it just meant "wow!" (Steinhardt 12). All this to say, Steinhardt's presentation of "quasicrystals" violated the very laws of physics Feynman taught in his famous lectures—and Feynman was duly impressed.

Before moving forward with his quest to solve the quasicrystal mystery, Steinhardt takes another slightly larger step back, to France in the late 1700s. He lays the foundation for his story, introducing his readers to René Just Haüy, a French priest whose studies of various minerals and their physical structures earned him the moniker "The Father of Modern Crystallography."

Steinhardt also includes some helpful illustrations and detailed but digestible explanations of the fundamentals and history of crystallography in these early pages. Any crystallographer could skim over these parts, but for someone less familiar with the field, Steinhardt's clear tone and helpful descriptions early on make the narrative easy to keep up with later in the book.

One of the interesting early segues in Steinhardt's book involves Dan Shechtman, who won the Noble Prize in 2011 for the experimental proof of quasicrystals. Shechtman was working in a Maryland laboratory in the early 1980s when he discovered five-fold symmetry in a synthetic aluminum alloy-around the same time that Steinhardt was working on his theoretical explanation. But the two men were unaware of each other's research at the time. Shechtman's discovery was determined "impossible" and his paper was rejected by *The Journal of Applied Physics*. Steinhardt laments "if there had ever been any exchange between our two teams there is a good chance we would have joined forces and presented the theory and experiment together" (Steinhardt 79). However, if that had been the case, this would be a very different story.

The rest of the book follows Steinhardt's research into naturally occurring quasicrystals, spanning more than three decades. Quasicrystals, whether natural or man-made, break those fundamental laws Steinhardt laid out so eloquently in his first 25 pages.

The Second Kind of Impossible is a must read. Even if you have no interest in quasicrystals or five-fold crystalline structures, Steinhardt's book is a delight. The 364-page book reads like a novel—and a fast-paced, well-written one at that. Steinhardt manages to maintain a quick and thrilling pace without skimping on the science behind the story.