Could the Next Einstein Be a Surfer Dude?

Totally rad! Meet six iconoclasts who could revolutionize physics—again.

BY **STEPHEN CASS** AND **AMOS KENIGSBERG**

Albert Einstein appeared on the scientific stage so suddenly, so unexpectedly, that it is impossible not to wonder whether his successor might already be toiling away in a lab or patent office somewhere. If Einstein 2.0 is out there, though, how would we recognize him or her?

Lee Smolin of Perimeter Institute for Theoretical Physics in Ontario, Canada, suggests some key qualities to look for. A deep understanding of physics is crucial, of course, but the trait that will define the next Einstein is something a little less scientific: daring. Einstein's 1905 papers are breathtaking in ambition and scope, drawing on philosophy and thought problems as well as on the research of his time. The next Einstein will "come into physics and solve simultaneously a number of the key foundational issues, setting into motion great advances with immediate experimental implications," Smolin says. Certainly the challenges are out there. Nobody has managed to reconcile quantum mechanics with the rules of Einstein's general relativity, for instance; at a deeper level, we still do not even know why the laws of physics are the particular way they are.

With Smolin's aid, DISCOVER has scoured the landscape and found six top candidates who show intriguing signs of that Einsteinian spark. Smolin is too modest to say so, but he might qualify as a seventh; with physicist Fotini Markopoulou-Kalamara (our number-five pick) he works on loop quantum gravity, a promising, left-field approach to making peace between the quantum and relativity worlds.

Like Einstein, these six researchers "are over and over again stimulating us with new ideas, with new approaches to things that could be right," Smolin says. But as Einstein cautioned, "Any intelligent fool can make things bigger and more complex. It takes a touch of genius and a lot of courage to move in the opposite direction." We on the sidelines are still waiting to see when and where that genius will strike next.

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1. Garrett Lisi: Age 40, holds no faculty position but earned a Ph.D. at UCLA; lives off grants and software consulting. **Body of work:** Recently published "An Exceptionally Simple Theory of Everything," aiming to unify physics based on the geometry of a 248-dimensional figure called E_8. This figure shows remarkable connections with known forces and particles. But Lisi's equations may have problems with mass and spin. **Einsteinian trait:** "Surfer dude" Lisi is more of an outsider than the onetime patent clerk.

2. Stephen Hawking: 66, University of Cambridge, England. **Body of work:** Showed that black holes are not entirely black by studying quantum effects near a hole's border, or event horizon, but his work has not yet sparked a fundamental revolution in physics. **Einsteinian traits:** Publicly worries about the big picture of our future; is the popular face of physics.

3. Mordehai Milgrom: 61, Weizmann Institute, Israel. **Body of work:** His modified Newtonian dynamics (MOND) says gravity does not follow Newton's laws when it is very weak. MOND explains the strange rotation of galaxies without positing the existence of dark matter. But it does not unify gravity with quantum theory. **Einsteinian trait:** Came up with MOND at the Institute for Advanced Study, Einstein's old stomping grounds.

4. Giovanni Amelino-Camelia: 42, University of Rome–Sapienza, Italy. **Body of work:** His "doubly special relativity" posits that the supposedly constant speed of light actually depends on its wavelength and that space has a minimum distance. His theory could unify physics and help explain the early growth of the universe, but experimental proof seems to be a tall order. **Einsteinian trait:** Rejects accepted physics on the basis of logic arguments.

5. Fotini Markopoulou-Kalamara: 36, Perimeter Institute for Theoretical Physics, Canada. **Body of work:** Works on loop quantum gravity, which says abstract loops compose matter and space. This theory has derived some real physical properties from pure math; it quantifies what space is and unifies quantum and gravitational realms, but it is short on experimental proof. **Einsteinian trait:** As a child Markopoulou-Kalamara dreamed of being almost anything but a physicist.

6. Ed Witten: 56, Institute for Advanced Study, New Jersey. **Body of work:** Godfather of string theory; instrumental in creating M theory, which unites various string theories. M theory has no hard proof, raising the possibility that it is only an extremely difficult version of sudoku. **Einsteinian trait:** His otherworldly intelligence leads some to joke that he is an alien, a charge also leveled at Einstein.