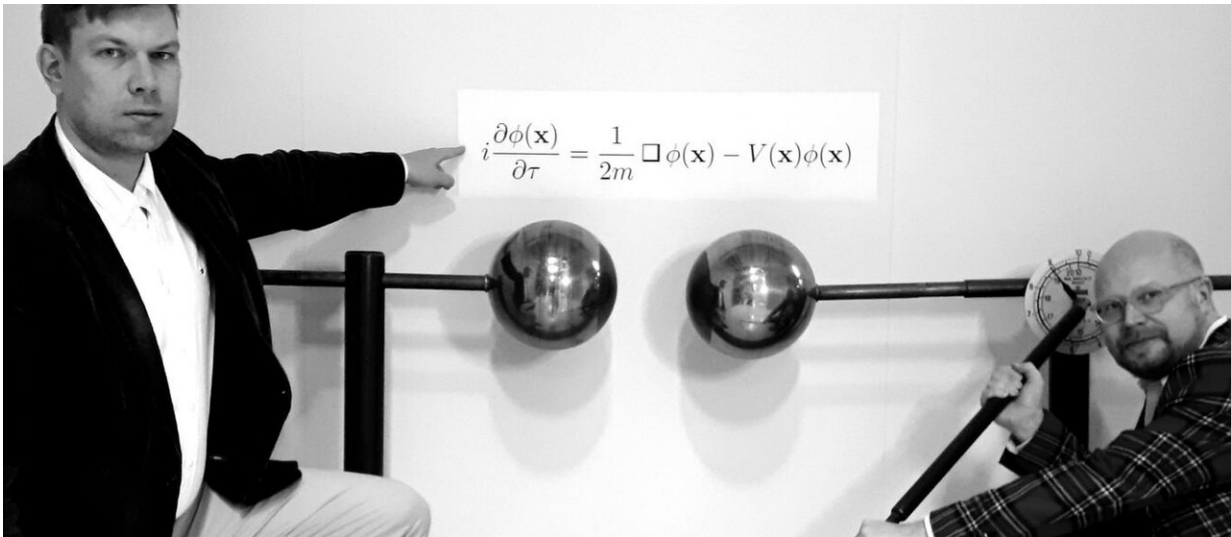


# Rewriting quantum mechanics in their spare time

December 31 2019

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The study took Jussi Lindgren, left, and Jukka Liukkonen, right, back to year 1941 when Stueckelberg's wave equation was invented. The equation is the foundation for parameterized relativistic dynamics. Credit: Aalto University

As students, Jussi Lindgren and Jukka Liukkonen had found one element of their quantum mechanics lectures unsatisfying. "When we were taught physics, there were some fundamental elements you were told were true, and you had to accept they were true without it being shown why," said Jussi Lindgren, "and I didn't really like this".

Working as a hobby alongside their jobs in the Finnish government, and

Lindgren's Ph.D. work in systems analysis at Aalto, the researchers devised a new method for expressing the laws of quantum mechanics using stochastic methods, a type of mathematics that deals with random chance and probability.

The paper, published 27 December in *Scientific Reports* explores how stochastic methods can be used to derive a variety of equations in [quantum mechanics](#) from first principles, as opposed to having to build from ad hoc prior postulates. "The method will be useful for teachers or learners because it gives a better understanding of the reason why something is correct," said Jukka Liukkonen.

**More information:** Jussi Lindgren et al. Quantum Mechanics can be understood through stochastic optimization on spacetimes, *Scientific Reports* (2019). [DOI: 10.1038/s41598-019-56357-3](https://doi.org/10.1038/s41598-019-56357-3)

Provided by Aalto University

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