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Resonance Cascades as a Tool of Quantum Number Theory

jeudi 8 février 2024 09:15 (45 minutes)

In this presentation, we consider situations where the existence of a contiguous cascade of quantum resonant transitions is predicated on the validity of a particular statement in number theory. As a case study, we look at the following trivial statement: "Any power of 3 is an integer."

Consequently, we "test" this statement in a numerical experiment where we demonstrate an un-impeded upward mobility along an equidistant, $\log(3)$-spaced subsequence of the energy levels of a potential with a log-natural spectrum, under a frequency $\log(3)$ time-periodic perturbation. With the knowledge gained in this project, we consider similar schemes aimed at two more number-theoretical statements: "Any product of two sums of two squares of integers is a sum of two squares of integers" (this one can be proven using the Diophantus-Brahmagupta-Fibonacci identity) and "Any even is a sum of two primes" (i.e. the Goldbach conjecture, still unproven).

The empirical relevance of all three projects is ensured by the current experimental progress in creating cold-atomic potentials with a tailored quantum spectrum, in the laboratory of Donatella Cassettari (U of St. Andrews).

In collaboration with Oleksandr Marchukov, Andrea Trombettoni, Giuseppe Mussardo, and Donatella Cassettari.

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