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A Quantum Simulation on the Emergence of Lorentz Invariance DAVID ZUECO, FERNANDO QUIJANDRÍA, Universidad de Zaragoza, DIEGO BLAS, CERN, ORIOL PUJÒLAS, Universitat Autònoma de Barcelona — Lorentz invariance (LI) is one of the best tested symmetries of Nature. It is natural to think that LI is a fundamental property. However, this does not need to be so. In fact, it could be an emergent symmetry in the low energy world. One motivation on Lorentz-violating theories may come from consistent non-relativistic models of gravity, where LI appears at low energies. The basic approach is by taking two interacting quantum fields. The bare (uncoupled fields) have different light velocities, say v1 and v2. The coupling tends to "synchronize" those velocities providing a common light velocity: the LI emergence. So far, only perturbative calculations are available. In this perturbative regime the emergence of LI is too slow. Therefore it is mandatory going beyond perturbative calculations. In this talk I will discuss that such models for emergent Lorentz Invariance can be simulated in an analog quantum simulator. In 1+1 dimensions two transmission lines coupled trough Josephson Junctions do the job. We show that the emergence can be checked by measuring photon correlations. Everything within the state of the art in circuit QED. We show that our proposal can provide a definite answer about the LI emergence hypothesis in the strong coupling regime.

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