Contribution ID: **5** Type: **not specified**

Detecting single gravitons with quantum sensing

Tuesday, 5 December 2023 14:45 (12 minutes)

The quantization of gravity is widely believed to result in gravitons – particles of discrete energy that form gravitational waves. But their detection has so far been considered impossible. Here we show that signatures of single gravitons can be observed in laboratory experiments 1. We show that stimulated and spontaneous single-graviton processes can become relevant for massive quantum acoustic resonators and that stimulated absorption can be resolved through continuous sensing of quantum jumps. We analyze the feasibility of observing the exchange of single energy quanta between matter and gravitational waves. Our results show that single graviton signatures are within reach of experiments. In analogy to the discovery of the photoelectric effect for photons, such signatures can provide the first experimental evidence of the quantization of gravity.

Our work is outlined in
G. Tobar, S. K. Manikandan, T. Beitel and I. Pikovski, arXiv:2308.15440
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Session Classification: Theory