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Graviton detection and the quantization of gravity

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We revisit a question asked by Dyson: “Is a graviton detectable?” We demonstrate that in both Dyson’s original sense and in a more modern measurement-theoretic sense, it is possible to construct a detector sensitive to single gravitons, and in fact a variety of existing and near-term gravitational wave detectors can achieve this. However, while such a signal would be consistent with the quantization of the gravitational field, we draw on results from quantum optics to show how the same signal could just as well be explained via classical gravitational waves. We outline the kind of measurements that would be needed to demonstrate quantization of gravitational radiation and explain why these are substantially more difficult than simply counting graviton clicks or observing gravitational noise in an interferometer, and likely impossible to perform in practice.

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