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Sub-Fourier Frequency Resolution with a Quantum Sensor[1] SARA MOURADIAN, ELI MEGIDISH, NEIL GLIKIN, KAI-ISAAC ELLERS, HARMUT HAEFFNER, University of California, Berkeley — Resolution of the frequency components of a time-dependent signal is conventionally limited by the total measurement time. This limits spectroscopy of signals with short coherence times. Here, we demonstrate sub-Fourier resolution of the frequency components of an incoherent signal with at most two frequencies using a quantum sensor. In particular, we pick a measurement time at which the quantum sensor will be in an eigenstate if there is only one frequency and perform a measurement in that basis. Thus, we take advantage of the fact that quantum projection noise approaches zero as the measured state approaches a basis state. Using this protocol, we are able to measure a frequency separation of 200Hz with a sensitivity of 11 $Hz/\sqrt{\text{Hz}}$ at a measurement time of only 2ms.

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