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Quantum sensor networks as exotic field telescopes for multi-messenger astronomy

Tuesday, 9 December 2025 10:00 (30 minutes)

Multi-messenger astronomy, the coordinated observation of different classes of signals originating from the same astrophysical event, provides a wealth of information about astrophysical processes. The focus of multi-messenger astronomy has been the search for conventional signals from known fundamental forces and standard model particles, like gravitational waves. In addition to these known effects, quantum sensor networks could be used to search for astrophysical signals predicted by beyond-standard-model theories. Of particular interest are exotic low-mass fields (ELFs) that can be emitted by cataclismic astrophysical events. I will review our original proposal [Nature Astronomy 5, 150 (2021)] for multi-messenger astronomy in the exotic physics modality and discuss theoretical progress. I will also present results of our search for ELFs temporally correlated with GW170817 merger, where we use the global network of GPS satellite atomic clocks as a distributed detector. We analyze clock data from the GPS constellation in windows bracketing the LIGO–Virgo trigger, constructing correlated observables that are sensitive to propagating disturbances with velocities near the speed of light.

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