Contribution ID: **176** Type: **not specified**

Searching for dark matter using mechanical systems

Friday, 19 March 2021 12:50 (25 minutes)

When properly engineered, simple quantum systems such as harmonic oscillators or spins can be excellent detectors of feeble forces and fields. Following a general introduction, I will focus on using optomechanical systems as sensors of weak acceleration and strain fields. Dark matter particles coupling to standard model fields and particles would produce a coherent strain or acceleration signal in an elastic solid. We discuss the feasibility of searching for dark matter consisting of ultralight scalar or vector fields in the 10^-12 eV–10^-6 eV/c^2 mass range using various optomechanical systems. I will also show that understanding and addressing issues around quantum control are essential steps towards building quantum noise limited detectors.

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Session Classification: Quantum Sensors

Track Classification: Quantum Sensors