Quantum Sensing for Fundamental Physics

- Optical interferometry for gravitational wave detection:
  - Squeezed light, variational readout, backaction evasion, and other techniques can improve sensitivity.
- Microwave quantum optics for axion searches above $\sim 1\mu\text{eV}$:
  - Photon counting, squeezed microwave states speed up axion scan rate.

LIGO, cavity optomechanics

Gravitational wave detections

LIGO/Virgo/Georgia Tech/S. Ghonge & K. Jani

A22-305 Poster Highlight, 7/25/2019, LTD18
The RF Quantum Upconverter: extends quantum measurement techniques to lower frequencies

**Cavity optomechanics**
- Gravitational wave
- Spring
- Movable mirror
- $\omega_b \approx 100\text{Hz}$
- $\omega_a(x) \approx 300\text{THz}$

**Axion detector with RQU**
- Dark matter
- LC resonator
- Flux-variable inductor
- $\omega_b \approx 10\text{MHz}$
- $\omega_a(\Phi) \approx 6\text{GHz}$

**A22-305: Sensors for Quantum Coherent Dark Matter Detectors**