Quantum Sensors (IF1) Readout Needs

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Quantum Sensors Topic

The Quantum Sensors subgroup covers sensors that leverage quantum phenomena to make measurements by manipulating quantum states, entanglement, superposition, etc.

- Ultralight wavelike dark matter
- Scattering /absorption of dark matter particles
- Electric dipole measurements
- Dark energy
- Violations of fundamental symmetries
- New forces or particles

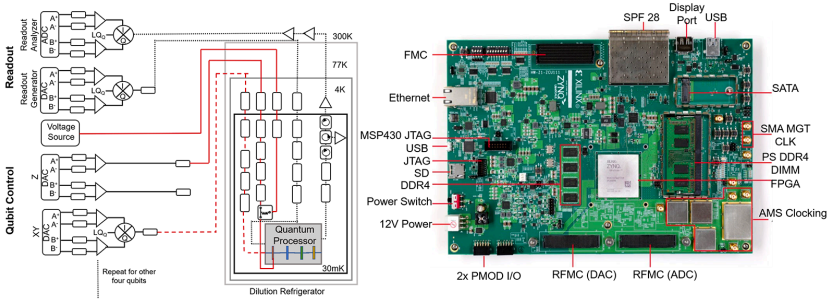
Interfaces

The development of quantum sensor technology overlaps with several other frontiers

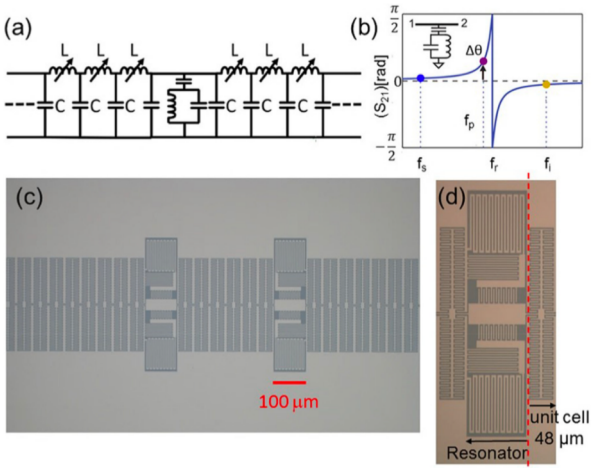
- IF7 Electronics – RF readout electronics, cryogenic multiplexers, cryogenic amplifiers
- IF2: Photon Detectors – TES / MKIDs / Nanowires
- AF5: Accelerators for PBC and Rare Processes – RF cavities

Readout Needs

- Room temperature RF control systems
  - More channels
  - Integrated firmware and software
- Cryogenic multiplexing – SQUID and CMOS
  - Higher multiplexing density
  - Simplified interfaces
- Cryogenic amplifiers – HEMT and parametric
  - Broad bandwidth
  - Low noise
  - Low cost



Mutli-qubit readout (ANL/FNL/MIT/UofC)



Parametric Amplifiers (SLAC/UCSB/NIST)

Conclusion

- New readout technologies will be needed for emerging quantum sensors
- Currently, HEP is most familiar with superconducting sensors; other technologies (solid state spins, atomic vapors) are beginning to gain use
- Additional requirements will emerge as LOIs are submitted.