

Research and development towards an axion search experiment using quantum sensing of magnons

Thursday, 14 March 2024 17:25 (20 minutes)

“We plan to search for axion dark matter through their interactions with electron spins. Axion wind from the dark matter halo in our galaxy creates an effective magnetic field that induces quanta of collective electron spin wave excitations called magnons in ferromagnetic crystals like Yttrium Iron Garnet (YIG). We plan to observe these axion-induced magnons using a hybrid magnon - photon - superconducting qubit system to perform search for axions and axion-like particles at ultra-cryogenic temperature. As a part of our R&D, we are currently building a hybrid magnon - photon system with improved YIG volume to increase the axion induced magnon signal. At ultracryogenic temperature, axion search is ultimately limited by the Standard Quantum Limit (SQL) arising due to the Heisenberg’s uncertainty principle. To overcome this limit, we plan to perform magnon - counting using superconducting qubit in contrast to the conventional microwave cavity based magnon readout. Thus, with improved detector volume and the use of superconducting qubit based quantum sensing techniques, we hope to reach unprecedented sensitivity in magnon-based axion search.”

Presenter: SINGH SHRESTHA, Yaman (The University of Tokyo)

Session Classification: Oral