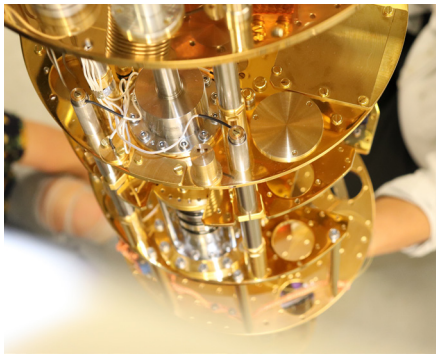
Probing the quantum realm

Konrad Lehnert
Eugene Higgins Professor of Physics

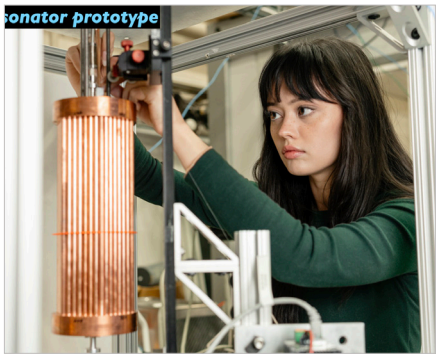
Konrad Lehnert is a global leader in quantum science and sensing, the fundamental physics of quantum measurements, and the development of quantum technologies based on these concepts. Lehnert is recognized for his exceptionally deep knowledge of the phenomenology of superconductivity and of mesoscopic systems in the quantum context, with particular expertise in quantum noise.

Lehnert has been elected a Fellow of the American Physical Society and the American Association for the Advancement of Science, and he held Kavli Fellowships in 2010 and 2011. In 2020, he won a highly competitive five-year Vannevar Bush Faculty Fellowship, the U.S. Department of Defense's most prestigious single-investigator award.



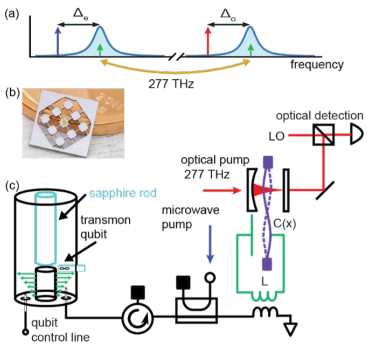
Haloscope At Yale Sensitive To Axion Cold Dark Matter (HAYSTAC)

The HAYSTAC at Yale group develops and uses experiments to search for axions, which are very low mass particles that are a theorized candidate for dark matter. HAYSTAC is a tunable radiofrequency cavity resonator that serves to build up the axion signal. HAYSTAC uses photon sensors often used for quantum computing, as well as an innovative quantum noise squeezing technique to speed up the data taking of the experiment. HAYSTAC is located at Wright Lab, and the Yale team is responsible for systems engineering, cryogenics, and magnetics. Lehenert has helped develop multiplexed readouts for large detector arrays that are of interest to astrophysics and has made significant contributions to HAYSTAC.



Axion Longitudinal Plasma HAloscope (ALPHA)

ALPHA will build on HAYSTAC's success and search for higher mass axions by employing a novel axion detector called a plasma haloscope. ALPHA, located at Wright Lab, will comprehensively investigate how new experimental ideas using plasmas can be used to detect the axion.



Quantum Information Science (QIS)

QIS has spawned a large and lively science and technology innovation environment. Underneath this enthusiasm lies an essential fact that was hiding in plain sight for 60 years. Information in a quantum description of nature is not just different than in its classical correspondence limit, but usefully so. Although QIS is a new frontier of knowledge, independent of its utility, the desire for science and technology impact helps guide Lehnert's research. Most of his research is guided by the following maxims: 1) a quantum advantage can be realized today in sensing and measurement 2) unanticipated innovations will come from extending quantum control and measurements into new technology domains. Lehnert's major QIS programs are: 1) entangling distant superconducting qubits with light, 2) advancing the science of quantum sound, and 3) quantum signal processing for quantum information and quantum sensing.

Yale

Wright Laboratory