

ICTS SPECIAL COLLOQUIUM

Atomic Interferometry to Probe the early and dark universe – Matter-wave Atomic Gradiometer Interferometric Sensor (MAGIS-100)

MAGIS-100 is a macroscopic 'Quantum-Sensor', based on a 100-meter light-pulse atom interferometer, being built at Fermilab by an international collaboration, in search of the "dark" sector of the universe ("dark" matter and energy) and "early-universe" gravitational wave background. The experiment can potentially search for new forces and test 'quantum mechanics' at large distances. The existing NuMI shaft at Fermilab will be used to install the 100-meter atom interferometer for fundamental sciences. Latest advances in atomic clock technologies using Strontium atoms will maximize the sensitivity of the experiment to demonstrate the efficacy and technical feasibility of long-baseline atom interferometers. This is an intermediate step towards a future earth-based 1 kilometre long-baseline atom interferometer set-up (e.g., in the Sanford Labs in South Dakota or elsewhere), with potentially sufficient sensitivity to detect stochastic cosmic background gravitational radiation from the early universe (predicted in the 0.1 Hz – 10 Hz range --- a 'band-gap' between the earth-based LIGO and space-based LISA experiments). Eventually, if successful, one can contemplate space-based interferometers in satellites. We give an overview of this international collaborative experiment and its scientific reach.



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Professor Swapan Chattopadhyay is a particle and accelerator physicist, with contributions to innovative particle colliders, synchrotron radiation sources, free electron lasers and "ultra-fast" sciences. In 2016, he helped initiate the US-DOE program in "Quantum Sensors for Fundamental Science, Quantum Information Science and Computing". Prof. Chattopadhyay is Distinguished Scientist Emeritus at Fermilab, honorary Scientific Associate at CERN, Faculty Guest Senior Scientist at LBNL/UC Berkeley, Adjunct Professor of Photon Science at SLAC/Stanford University, Infosys Chair Visiting Professor at IISc Bengaluru and Adjunct Professor of TIFR (ICTS). Formerly, he was the Inaugural Director and Sir John Cockcroft Chair of Physics at the Cockcroft Institute, UK (2007-2014), Associate Laboratory Director at Jefferson Lab (2001-2007) and Director, Center for Beam Physics at Berkeley (1984-2001). Prof. Chattopadhyay received his PhD (Physics) from University of California at Berkeley (1982), Bachelor's/Master's degrees from the University of Calcutta/IIT(Kharagpur) in India, respectively and did his post-doctoral research at CERN (1982-1984). He is a Fellow of the APS, AAAS (US), IoP (UK), Royal Society for Arts (UK), and a corresponding Fellow of the Royal Society of Edinburgh (UK).

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Zoom link: <https://rb.gy/jbfxsy>

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