Seminar

Institute for Plasma Research

Title : KAGRA detector: Large-Scale Cryogenic Gravitational Wave Telescope

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Date : 28th December 2016 (Wednesday)

Time : 11.00 AM

Venue : Seminar Hall, IPR

Abstract:

KAGRA detector is a 2nd generation, large-scale cryogenic gravitational wave telescope (LCGT), currently being built in Japan for the detection of gravitational waves. The arm-length of this interferometric gravitational wave detector is 3 km and is located 200 m underground in the Kamioka mine (at Kamioka village near Toyama city). KAGRA is a cryogenic temperature detector (mirrors and its suspension called cryogenic payload will be cooled to 20 K) which is unique when compared to other room temperature detectors around the world. Operating the detector at cryogenic temperature will reduce the thermal noise in the suspension (mirrors) and allow the instrument to achieve very high sensitivity which is essential to define the emerging field of gravitational wave astronomy. The cryogenic payload for KAGRA is in the form of multiple pendulum, housed in a cryostat (with four cryo-cooler units) operating at 20 Kelvin. The use of sapphire (Al_2O_3) as a substrate material for the suspension system is the baseline design for the KAGRA detector. Sapphire is a crystalline material and is an ideal candidate at low temperature since it exhibits extremely low mechanical loss and shows several benefits including good optical properties, high thermal conductivity and high Young's modulus.

In this talk I will discuss about the current status of the KAGRA detector, including the ongoing installation/testing activities at the detector site. The design and status of the cryogenic payload system, specifically focussing on the performance of the sapphire suspensions will also be discussed. Thermal noise (from test mass, fibres, bonds, mirror coatings etc.) is one of the important noise sources affecting the performance of the detector at frequencies below 100Hz. Hence I will discuss about the techniques to estimate and reduce the thermal noise. My talk will also include a brief history of the development of ultra-sensitive low noise suspensions system for detectors around the world (Advanced LIGO, GEO-HF and comparison with KAGRA).