GR 14: Gravitational Waves II

Time: Thursday 16:00–17:40 Location: ZEU/0255

GR 14.1 Thu 16:00 ZEU/0255

Implementation of a Stray Light Simulation for the Einstein Telescope — •Hanna Marozava[1], Thomas Hebbeker[1], and Achim Stahl[2] — [1]III. Physikalisches Institut A, RWTH Aachen University — [2]III. Physikalisches Institut B, RWTH Aachen University

The Einstein Telescope (ET) will be the first gravitational wave detector of the third generation. Stray light is a severe problem for modern interferometers with high sensitivity, as another noise source contributing to the interferometer output. A simulation is required to tune detector settings to avoid undesirable light paths and to optimize the shape, number and position of baffles.

This talk will present the progress in developing a concept for the reduction of stray light in ET and first results.

GR 14.2 Thu 16:20 ZEU/0255

Test setup for cryogenic sensors and actuators working towards the Einstein Telescope — •Robert Joppe[1], Thomas Hebbeker[2], Tim Kuhlbusch[1], Oliver Pooth[2], Achim Stahl[2], Timo Wittler[1], and Franz-Peter Zantis[1] — [1]III. Physikalisches Institut A, RWTH Aachen — [2]III. Physikalisches Institut B, RWTH Aachen

The Einstein Telescope will be the first gravitational wave detector of the third generation. The sensitivity goal, especially in the low frequency region, will be achieved among other improvements by cooling the main parts of the interferometer. The required electronic components, sensors and actuators needed for mirror alignment and active dampening of suspension resonances have to perform at cryogenic temperatures.

The talk presents the progress on the development of electronics, optics and mechanics within the E-TEST project. Furthermore the performance of our cryogenic UHV test setup and the characterization of light emitting diodes at low temperatures will be explicated.

GR 14.3 Thu 16:40 ZEU/0255

A Cryogenic Displacement Sensor and Actuator for the Einstein Telescope — Thomas Hebbeker[1], Robert Joppe[1], •Tim Kuhlbusch[2], Oliver Pooth[2], Purnalingam Revathi[2], Achim Stahl[2], Timo Wittler[1], and Franz-Peter Zantis[1] — [1]III. Physikalisches Institut A, RWTH Aachen — [2]III. Physikalisches Institut B, RWTH Aachen

The Einstein Telescope will be the first third-generation gravitational wave detector. In achieving an increase in sensitivity of more than one order of magnitude at low frequencies compared to current detectors, mitigating thermal noises is essential. Thus cooling the mirrors of the interferometer to cryogenic temperatures is required. Consequently parts of the vibration isolation systems of the mirrors need to be working at these low temperatures.

This talk will present the developement of an actuator with an integrated absolute displacement sensor operating below 20 K. Sensitivity of the sensor, forces of the actuator and thermal design will be discussed. This includes the effects of cryogenic temperatures on diodes of the sensor and the electromagnet of the actuator.

GR 14.4 Thu 17:00 ZEU/0255

Wireless power transfer for cryogenic sensors and actuators in the Einstein Telescope — •santosh mutum[1], christian grewing[1], andre zambanini[1], and stefan van waasen[1,2] — [1]Central Institute of Engineering, Electronics and Analytics, Electronic Systems, Forschungszentrum Jülich, Germany — [2]Faculty of Engineering, Communication Systems, University of Duisburg-Essen, Germany

Gravitational wave detectors have to be extremely sensitive by nature. Hence, a significant effort is required to investigate in optimizing the hardware setup to reduce noise impacts as much as possible. For the upcoming Einstein Telescope, an optical power and information transfer is proposed and investigated to limit the mechanical coupling of cables. Additionally, in order to achieve more sensitivity in the proposed third generation gravitational wave detector, the main optics and consequently the electronics of the interferometer need to be cooled down to cryogenic temperatures.

This talk will address the wireless power transfer for the sensor-actuator system. The concept of a wireless power transfer in cryogenic using laser and solar cell will be discussed as well as first measurements and estimations for the expected performance.

GR 14.5 Thu 17:20 ZEU/0255

Development and Testing of Composite Vacuum Tubes for the Einstein Telescope — •Purnalingam Revathi[1], Ralf Schleichert[2], Tim Kuhlbusch[1], Robert Joppe[1], Thomas Hebbeker[1], Oliver Pooth[1], and Achim Stahl[1] — [1]III. Physikalisches Institut B, RWTH Aachen — [2]Institut für Kernphysik, Forschungszentrum Jülich

The Einstein Telescope, a proposed third-generation gravitational wave detector, requires about a 120 km long set of vacuum tubes with diameters of up to 1 m. Due to the vacuum requirements and mechanical integrity, stainless steel tubes are the standard for ultra high vacuum applications. But even with higher material costs, composite tubes may be a promising alternative to reduce the overall costs and to open possibilities for an on site production. This talk presents the details of the development and testing of prototypes made of Glass Fiber Reinforced Plastic wound around a stainless steel liner. Vacuum pressure stability and overpressure tests have been performed. Finite element simulations were done to optimize the material choice and thicknesses. The possibility of integrating sensors to measure temperature and pressure will be discussed.