T 118: Gravitational waves 2

Time: Friday 9:00–10:00 Location: Geb. 30.23: 6/1

T 118.1 Fri 9:00 Geb. 30.23: 6/1

Correlating dark matter and gravitational waves from a dark Higgs mechanism — Torsten Bringmann[1], Tomás Gonzalo[2], Felix Kahlhoefer[2], •Jonas Matuszak[2,3], and Carlo Tasillo[4] — [1]Department of Physics, University of Oslo, Box 1048, N-0316 Oslo, Norway — [2]Institute for Theoretical Particle Physics (TTP), Karlsruhe Institute of Technology (KIT), 76128 Karlsruhe, Germany — [3]Institute for Theoretical Particle Physics and Cosmology (TTK), RWTH Aachen University, D-52056 Aachen, Germany — [4]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg, Germany

The next generation of gravitational wave (GW) detectors open up a new window to probe physics beyond the Standard Model in the early universe. An intriguing possibility are first order phase transitions in a dark sector giving rise to a stochastic GW background. In this talk I will discuss GW signals from a dark sector with a spontaneously broken gauge symmetry and a stable dark fermion. Requiring the freeze-out mechanism to reproduce the observed relic abundance of dark matter constrains the GW signal frequency to lie within the LISA sensitivity range. Finally I will consider a scenario with feeble coupling between the dark and Standard Model sector, allowing the temperatures of the two sectors to evolve independently during the phase transition.

T 118.2 Fri 9:15 Geb. 30.23: 6/1

Detectability of Gravitational Waves from Core-Collapse Supernovae for the Einstein Telescope — Markus Bachlechner, Thilo Birkenfeld, •Timo Butz, and Achim Stahl — III. Physikalisches Institut B, RWTH Aachen

Core-collapse supernovae are interesting source candidates for gravitational wave detectors. Measurements of gravitational waves from such events can provide information on the physical processes occurring during the core-collapse of massive stars, especially with multi-messenger detections. The proposed Einstein Telescope, as the first of the third generation of gravitational wave detectors, is predicted to be an order of magnitude more sensitive in the whole frequency band compared to the previous generation. Therefore, an increased event rate due to the enlarged observable volume and the ability to study details of the underlying mechanism are expected.

This talk presents an analysis of the capability to detect core-collapse supernovae with the Einstein Telescope and prospects to extract information on the progenitor star.

T 118.3 Fri 9:30 Geb. 30.23: 6/1

Test setup for cryogenic sensors and actuators working towards the Einstein Telescope — Charlotte Benning[2], Thomas Hebbeker[1], •Robert Joppe[1], Tim Kuhlbusch[2], Oliver Pooth[2], Achim Stahl[2], 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 in particular by cooling the main parts of the interferometer. The required electronic components, sensors and actuators needed for mirror alignment and active damping 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.

T 118.4 Fri 9:45 Geb. 30.23: 6/1

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

Thermal noise at room temperature would limit the sensitivity of future gravitational wave detectors in the lower frequency region. Cooling the optical components of the interferometric detector reduces the thermal noise but adds constraints for their suspension system. The Einstein Telescope, a foreseen next-generation European gravitational wave detector, requires an operating temperature below 20 Kelvin.

This talk will present the development of an actuator with an integrated absolute displacement sensor optimized for these temperatures. The sensitivity of the sensor and range of the actuator must be maintained at low temperatures while reducing produced heat. Measurements of all optical components of the sensor were performed to optimize the cryogenic performance. The produced heat was analysed and options to reduce the thermal load will be discussed.