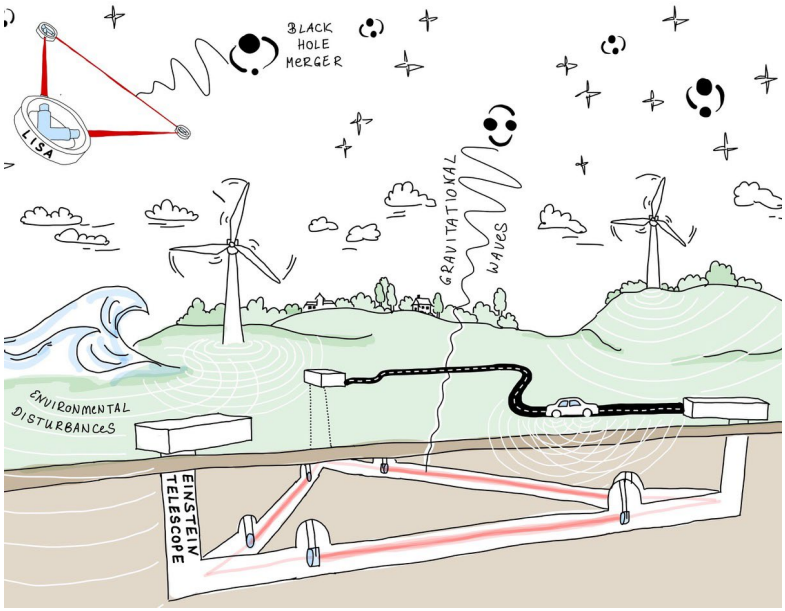
Physikalisches Institut
Fakultät für Mathematik und Physik
Albert-Ludwigs-Universität Freiburg

PHYSIKALISCHES KOLLOQUIUM

AM 13. JANUAR 2025 UM 17 UHR C.T.

IM GROßEN HÖRSAAL



LISTEN TO THE UNIVERSE WITH GRAVITATIONAL WAVE DETECTORS

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Since the first detection of gravitational waves in 2015, instruments like LIGO and Virgo have revealed over 100 events involving colliding black holes and neutron stars. These ripples in spacetime allow us to explore parts of the universe we cannot see with light but can make hearable through laser interferometry.

Detecting gravitational waves requires highly sensitive, large-scale laser interferometers, which measure the relative distance between suspended mirrors, acting as test masses, with incredible precision down to 10e-21 / √Hz. However, on Earth, seismic noise limits the sensitivity of these instruments at lower frequencies. The Einstein Telescope (ET), a next-generation gravitational wave observatory, is designed to overcome these challenges, enabling detections at frequencies even below 10 Hz. This will involve advanced technologies to mitigate noise, especially Newtonian Noise, which arises from Earth's mass density fluctuations caused by seismic activity.

In this talk, I will introduce the field of gravitational wave astronomy, explain the principles of detectors, and discuss how future observatories like the Einstein Telescope aim to address noise sources to open up this low-frequency frontier. If successful, the Einstein Telescope will detect mergers of more massive objects, from greater distances, and at earlier stages than ever before. This will not only deepen our understanding of the universe and revolutionize multi-messenger astronomy but also uncover unprecedented discoveries about the cosmos.