

Bachelor/Master's Thesis

The Einstein Telescope (ET) is a proposed underground infrastructure to host a third-generation, gravitational-wave observatory. It will achieve greatly improved sensitivity by increasing the size and implementing new technologies. In line with ET, the ECAP/work group of Stefan Funk takes an active part in developing a conceptual new phase camera, as a tool for monitoring and shaping the laser beam in the interferometer.

Design and characterisation of a bench top optical interferometer

In order to develop the phase camera, one needs a suitable image source to test the functionality of it. As this is a phase camera, a specialised optical setup is needed to make the phase of infrared light visible to the camera. Herefore, a heterodyning setup is used, which creates an amplitude beating pattern that corresponds to the phase of the incident light, which is measurable by photo diodes. This setup has to be build and tested in such a way that it is possible to inter-cooperate it into the ET interferometer. Of particular interest is how the interference of the two beams influences the generation of the beating pattern.

Development of a scanning configuration for a 1D camera setup

Fast sampling and digitisation (500MSa/s) is expensive. Instead of building a 2D pixel array, we also plan to build an 1D setup which the laser beam scans across, squaring the number of available pixel from 64 to 4096. To then generate a 2D image, one must precisely know the position of the beam at anytime. The goal is to build and test a setup to characterise a suitable Piezo mirror that can handle frequencies up to several kHz and then to synchronise it with the data taking of the camera. Due to the scanning process, image artefacts will be introduced which need to be characterised and tested, if they restrict the phase resolution of the camera.

Physics topics related to this work

- Gravitational-wave observatories
- Optics systems
- State-of-the-art electronics

Skills acquired during this work

- Hands-on lab experience
- Statistical analysis of data
- Programming in Python

Interested? Please get in touch!

- Prof. Stefan Funk, s.funk@fau.de
Raum 02.036, ECAP Laboratory
- Benjamin Schwab, ben.schwab@fau.de
Raum 02.044, ECAP Laboratory

