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The Einstein Telescope and the exotic physics it may reveal

Since the first discovery of gravitational waves about a decade ago, physics has gone into the era of gravitational wave astronomy. With the current detectors, over one hundred signals have been detected in the last ten years. With the Einstein Telescope, the detection rate is expected to go up by five to six orders of magnitude, leading to a wealth of data about black holes, cosmology, and the laws of physics themselves. One type of object that is expected to test our understanding of fundamental physics, and General Relativity in particular, is the ECO: an exotic compact object that mimic black holes, but can have quite different properties.

In these lectures, we will go through an overview of the Einstein Telescope, derive GR in a novel way, and build up the theory (e.g. BH perturbation theory, quasi-normal mode spectra, and the theory of compact objects) needed to predict ECOs and understand their general properties.

The level of the lectures is such that non-experts can participate, and include as assignment to construct your own gravastar model.