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Hunting for gravitational waves in the era of cosmic dawn

Over the past decades, observations have established a sample of more than 200 bright Active galactic nuclei (AGN), powered by accretion onto massive black holes, in the first billion years of the Universe. The James Webb Space Telescope has significantly revised this sample by yielding a sample of unexpectedly numerous and large black holes (up to a 100 million solar masses) within the first 600 million years, posing an enormous challenge for black hole and galaxy formation models. Starting with possible pathways for creating such heavy black holes in the early Universe, I will show a census of the black holes and their properties expected through cosmic time. I will use these to highlight the gravitational wave event rates expected to be detected by LISA (the Laser Interferometer Space Antenna). Straddling the fields of cosmology, galaxy formation and black hole physics, I will show how theoretical models that couple the evolution of dark matter halos, their baryonic components and their black holes are crucially required to make predictions for facilities such as LISA.

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