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The Science and Technology of LISA[1]

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LISA has long been recognized as an extraordinarily bold mission with an unprecedented huge discovery potential that can not be unlocked from ground or by any other space mission. LISA's observations of gravitational waves in the 0.1mHz to 1Hz frequency range will allow us to study the astrophysics and evolution of black holes, of compact galactic binaries, and of the universe itself. LISA will provide precise measurements of the masses, spins, and luminosity distances of merging massive black holes (MBH) out to the borders of the visible universe. The details in the gravitational waves generated by compact stars falling into a MBH allow us to trace out space time in the strong field limit; the ultimate test of general relativity in an otherwise difficult to study regime. These extreme mass ratio inspirals as well as the MBH mergers will help to understand the evolution of MBHs found for example in the center of most galaxies. The luminosity distances together with red shift measurements from parallel electro-magnetic observations of the host galaxies will produce precise absolute distance measurements on cosmological scales. This enables us to calibrate the Hubble diagram out to red shifts of z=15 shining light on the properties of "dark energy" throughout the universe. The astrophysics, evolution, and density of ultra-compact objects such as white dwarfs, neutron stars, and stellar size black holes is another science area covered by LISA. LISA will resolve and measure the properties of several 100 individual binaries. In addition, several ten thousand mostly WD binaries will form a gravitational-wave background which contains information about the density of WD binaries in our galaxy. I will review the science case for LISA and will give a brief overview over the technology, and the status of the LISA project.

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