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Title: Laser interferometry for gravitational wave observation: LISA and LISA Pathfinder

Presenter: Felipe Guzman

Abstract:

The Laser Interferometer Space Antenna (LISA) is a planned NASA-ESA gravitational wave observatory in the frequency range of 0.1mHz-100mHz. This observation band is inaccessible to ground-based detectors due to the large ground motions of the Earth. Gravitational wave sources for LISA include galactic binaries, mergers of supermassive black-hole binaries, extreme-mass-ratio inspirals, and possibly from as yet unimagined sources.
LISA is a constellation of three spacecraft separated by 5 million km in an equilateral triangle, whose center follows the Earth in a heliocentric orbit with an orbital phase offset of 20 degrees. Challenging technology is required to ensure pure geodetic trajectories of the six onboard test masses, whose distance fluctuations will be measured by interspacecraft laser interferometers with picometer accuracy.
LISA Pathfinder is an ESA-launched technology demonstration mission of key LISA subsystems such as spacecraft control with micronewton thrusters, test mass drag-free control, and precision laser interferometry between free-flying test masses.
Ground testing of flight hardware of the Gravitational Reference Sensor and Optical Metrology subsystems of LISA Pathfinder is currently ongoing.
An introduction to laser interferometric gravitational wave detection, ground-based observatories, and a detailed description of the two missions together with an overview of current investigations conducted by the community will be discussed. The current status in development and implementation of LISA Pathfinder pre-flight systems and latest results of the ongoing ground testing efforts will also be presented.