

# **From LISA Pathfinder to LISA: towards a low frequency gravitational wave observatory in space**

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The LISA -- Laser Interferometer Space Antenna --observatory will use an interferometric measurement of the gravitational tidal deformation of a constellation of free-falling test masses composing a 2.5 million km triangle, for high resolution measurement of gravitational waves in the frequency band from 20 microHz to nearly 1 Hz. This observational window includes a wide range of astrophysics not currently accessible from the ground, including supermassive massive black holes and thousands of resolvable mHz galactic compact object binaries, as well as an enormous discovery space for new physics and astrophysics. LISA Pathfinder has demonstrated that macroscopic test masses can serve as references of pure geodesic motion sub-femto-g precision and that they can be tracked interferometrically with sub-pm precision, both as required by LISA. This talk addresses the measurement science needed for LISA, what has been demonstrated and what remains a challenge for the ESA study of LISA, currently in the phase A.