

From the Geosphere to the Cosmos: ASPERA Workshop

Abstract

Gravitational wave antennas and seismology

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Curriculum Vitae :

Philippe Lognonné is Professor of Geophysics at University of Paris Diderot and leader of the Planetary and Space geophysics of IPGP –Sorbonne Paris Cité. He was Principal Investigator of several attempts to deploy Mars or Moon seismic experiments (Mars96, NetLander, Humboldt-ExoMars) and has contributed to recent re-analysis of the Apollo Seismic experiment and to the design of new generation earth gravity mission concept using the LISA technology (e.g. Licody).

Abstract :

Since the mid 60th, synergies and links between gravitational wave antenna and seismology have been developed. The amplitudes of the free oscillations of the Earth have been for example used to provide the first observational limit on the cosmic flux of gravitational waves (Weber, 1967). The Apollo 17 mission deployed also a gravimeter on the Moon in December 1972, which primary goal was the detection of gravitational waves (Weber, 1971). Due to a malfunction, this instrument was not able to provide data with sufficient sensitivity, but it nevertheless operated as low gain seismometer and detected Moon quakes and meteorites impacts.

We review in this presentation the sensitivity of the seismological sensors and compare them to those requested for gravitational wave antenna. This allow us to point out synergies, either in term of concept cross-fertilisations (e.g. using a LISA based Space system in earth's orbit for detecting very low amplitude Earth's normal modes) or in term of common development requested to increase furthermore the performances of future instruments. We also review the present knowledge of the seismic noise of the Earth and Moon as well as the techniques able to process and therefore to model and numerically compensate this noise from gravitational waves detectors. We conclude by presenting some perspectives, both in term of geophysical observation on the existing and future gravitational waves or on fundamental physics observation on the existing and future Earth's and Moon geophysical instruments.
