Proposition de stage de Master 2 en Astrophysique

Master IMAG2E, Université de Nice-Sophia Antipolis.

Nom et prénom du proposant : Guust Nolet

Laboratoire et Equipe : Geoazur , equipe sismo

e-mail : nolet@geoazur.unice.fr

Téléphone : 04.83.61.86.32

Site : Sophia Antipolis (250 rue Einstein, Bat 4)

Titre du sujet : The Earth's response to gravitational waves

Résumé , contexte, bibliographie, profil de l'étudiant (20 lignes maximum) :

Current efforts by physicists to detect gravitational waves use sensors with lengths equivalent to several km, such as the VIRGO and LIGO strainmeters. Since gravitational waves are expected to produce strains of the order of 10^{-20} at most, a 1000 m long sensor wil only deform by 10^{-17} m, even smaller than the width of a proton. An old idea by Freeman Dyson was to use the Earth's crust, with a thickness of 35 km, as a resonator. This was, however not a very practical idea because much of the seismic noise in the Earth is trapped in the crust.

An alternative is to use the whole Earth as a gravitational antenna. Gravitational waves could set up tidal oscillations (that is, vibrations with only two nodal lines on the earth's surface). If the frequency of the gravitational wave is in resonance with one of the free tidal oscillation frequencies of the Earth, resonance will occur and the motion may be amplified multiple times. Especially if the source of the radiation is continuous, as it is with spiraling binary stars.

The aim of this project is to determine what the noise level in the Earth is in the frequency band of interest if we measure its spectrum over long periods of time, rejecting periods when the Earth is excited by earthquakes, and using only the lowest-noise seismic stations.

No deep knowledge of relativity theory is needed since we shall focus on the time series analysis rather than the physics of gravitational waves. The student needs to be familiar with Fourier analysis and have some experience with computers (we use a Linux system).

Une suite en thèse est-elle possible ?

Guust Nolet prend sa retraite en 2014.