



Irfu

Institut de recherche
sur les lois fondamentales
de l'Univers

**Séminaire
DPhP**

Lundi 27/01/2020, 11h00

CEA-Saclay Bât. 141, salle André Berthelot

Detecting High-Frequency Gravitational Waves with Intense Magnetic Fields

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Electromagnetic detectors (and generators) of gravitational waves have been considered since the early 70s, besides of the mechanical detectors and laser interferometers. The so-called Gertsenshtein effect describes the generation of gravitational waves when light passes through some constant magnetic field. However, it is the reverse phenomena – electromagnetic waves arising when incoming gravitational waves interact with a constant magnetic field – that can be used to design electromagnetic detectors of high-frequency gravitational waves. We will present a numerical design of a new patented experimental setup, made of a TEM waveguide immersed into a strong external magnetic field, and its application for the detection of gravitational waves from inspiralling primordial black holes. We will show some typical shapes and amplitudes of the expected signal inside such detectors, including the induced electromagnetic power spectrum. For example, a binary system of two 10^{-5} solar mass primordial black holes located at distance of 1 GigaParsec generates a gravitational wave of strain 10^{-28} which, once passing through a detector of length 10m inside a 1T external magnetic field, produces a rms electromagnetic power of about 10^{-14} W, on a time scale of 50 microseconds. We conclude by some physical motivations for such experiments, notably from the science of primordial black holes or stochastic GW backgrounds from the early Universe.

Le café sera servi 10 minutes avant.

NB : La présentation d'une pièce d'identité est exigée à l'entrée du centre. Tous les auditeurs extérieurs sont priés de prévenir à l'avance Martine Oger, tél. 01 69 08 23 50, e-mail : martine.oger@cea.fr.