

Master 2: *International Centre for Fundamental Physics* INTERNSHIP PROPOSAL

Laboratory name: Laboratoire de Physique de l'ENS (LPENS)

CNRS identification code: UMR8023

Internship director's surname: C. Gissinger (gissinger@ens.fr)

webpage : <http://www.phys.ens.fr/~gissinger/index.html>

Internship location: Ecole Normale Supérieure PARIS

Thesis possibility after internship: YES

Funding: YES

Hydrodynamics of ocean worlds

Thanks to the growing amount of telescope observations and space missions in recent years, it is now increasingly clear that subsurface oceanic worlds are ubiquitous. For instance, it is believed that a vast ocean of salty water is present beneath the surface of several moons and planets of the solar system (Ganymede, Europa, Enceladus, Ceres, Titan, etc). Although this is perhaps the most common type of oceanic world, hydrodynamics of such subsurface oceans remains mostly unknown.

In this internship (which may be followed by a thesis), we propose to conduct both a theoretical study and a numerical modeling of these oceans. By taking into account for the first time magnetic field, thermal convection and tidal forces in a single model, the simulations will provide the first complete numerical model of such 'exo-oceanography'.

Simulations may be compared to observation data of Jovian moons in order to obtain a theoretical description of these oceans (heat budget, dynamics of the ocean). This model aims to elucidate the mechanisms keeping the water in a liquid state and the origin of the surprising geology of Europa's surface (water plumes and terrain chaos).

Condensed Matter Physics: YES *Soft Matter and Biological Physics:* YES

Quantum Physics: YES

Theoretical Physics: YES

