

OGMA TEAM : Contributions to Gravitational Wave & High Energy Neutrino Astronomy

The **OGMA** Team (*Observations with Gravitational waves & Multimessenger Astronomy*) is involved in High Energy Neutrino (HEN) Astronomy, with technical and physics contributions to the **ANTARES** and **KM3NET** GeV-PeV neutrino telescopes, and in Gravitational Wave (GW) Astronomy, with technical and physics contributions to the **VIRGO** interferometer. OGMA also contributes to MultiMessenger studies, i.e. combining data from GW, HEN and ElectroMagnetic (EM) instruments.

OGMA is involved in the search for GW events from the merger of compact objects (black holes BH or neutron stars NS), for realtime analyses or the production of signal catalogues, through the development of the analysis pipeline **MBTA**. With the start of the **O4 data taking period** of LIGO/VIRGO in Spring 2023, this internship is a good opportunity to discover Data Analysis in GW experiments, for instance by participating to the improvement of the determination of the distance of GW signals detected with MBTA.

Another major contribution of OGMA to VIRGO is the development of a new calibration technique, the **Newtonian Calibrator (NCal)**, based on the production of varying gravitational field thanks to a massive rotor. Several NCal have been installed on the VIRGO site, and regular calibration shifts are scheduled during O4. Again, the period of the internship coincides with these operations and could also constitute a Master internship.

The main multimessenger astronomy contribution of the OGMA team consists in combining GW and HEN data, both in realtime and offline, to show a possible connection between the production of the astrophysical jets producing HEN and the origin of their engines through GW emissions. These **GWHEN analyses** have to be consolidated for the incoming concomittant operations of VIRGO/LIGO and KM3NET instruments : this is a possible internship subject, relying on simulations of GW and HEN signals and archival data.

OGMA also takes part in the definition of the Neutrino followup campaigns that will be performed by the **GRANDMA** Telescope Network in the near future. After the detection of an interesting HEN candidate by KM3NET or **ICECUBE**, telescopes scan the sky in the direction of the incoming neutrino in order to discover a possible EM counterpart. This is needed in order to confirm the astrophysical origin of the neutrino, but also to identify the nature of the possible source. In order to optimize the **HEN followup strategy** with GRANDMA, studies relying on simulations of the source populations are needed, in the context of the forthcoming distribution of KM3NET HEN alerts by Summer 2023.

This work could be naturally extended during a PhD Thesis.

Internship Supervisor(s) : **PRADIER Thierry** and/or **MOURS Benoit**

Phone : +33 (0)3 88 10 6620 - Email : thierry.pradier@iphc.cnrs.fr

Composition of the Team - Scientific Contact T. Pradier (University Staff); A. Albert (University Staff), D. Drouhin (University Staff), B. Mours (CNRS Staff), D. Estevez (CNRS Post-doc), V. Juste (PhD), A. Syx (PhD), T. Sainrat (PhD)