Contributions to Gravitational Wave Astronomy
Getting ready for more events

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The OGMA Team is involved in Gravitational Wave (GW) Astronomy, with technical contributions to the Virgo interferometer (see also in Wikipedia) plus the analysis of the LIGO, Virgo and KAGRA data. The team is also involved in the low latency operations, leading to public alerts and enabling MultiMessenger astronomy.

The GW astronomy is a new field started a few years ago with the first observation of GW in 2015. It has been followed two years later by the first observation of GW plus electromagnetic signals (GRB, optical, radio). Since then, this field is rapidly evolving, thanks to the improvement of the detectors and new data taking, with about 300 events observed as of March 2025. Currently, the LIGO and Virgo detector are jointly operated as part of the fourth observing run (O4), detecting GW events at a typical rate of few events per week. The O4 run will stop in October to allow for detector upgrades before restarting observations in late 2027 with improved detection capability (see run schedule here).

The Virgo OGMA group is involved in the search for GW events from the coalescence and merger of binary systems of compact objects (black holes BH and/or neutron stars NS). It is focusing its data analysis effort on the development and deployment of the MBTA analysis pipeline. This includes realtime analyses to provide candidate events which are publicly broadcasted and the production of signal catalogues.

The proposed PhD work is to contribute to the analysis of the O4 data, improve the analysis for the O5 run and look at the first O5 results. The O5 detection rate is expected to increase by at least a factor 3 compared to O4, leading to new opportunities for discovery and challenges for the data analysis. The PhD work will have two main phases. First, a contribution to the offline analysis of the data collected during the O4 run in order to include the results in the catalogues. The second phase is to prepare the pipeline improvements for the O5 run, and contribute to the analysis of the first data of this run. The emphasis will be to improve the source classification, parameter estimation in low latency, key parameters for the selection of the appropriate events for MultiMessenger followup. The inclusion of the data coming from the Japanese KAGRA detector will be another topic.

The PhD student will become a member of the Virgo collaboration, in charge of the Virgo gravitational wave detector located close to Pisa in Italy. Since LIGO, Virgo and KAGRA share their data and have common data analysis teams and publications, the PhD student will be fully integrated in this joint effort and will work on LIGO, Virgo and KAGRA data.

Composition of the Virgo group as of March 1st, 2025 : F. Aubin (CNRS Post-doc), B. Mours (CNRS Staff), T. Pradier (University Staff), T. Sainrat (PhD), P. Van Hove (CNRS Staff), plus technical staff for the detector developments