

## XXXV cycle Ph.D. course in Physics

### Second Year Report

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**Supervisor:** Fiodor Sorrentino

#### RESEARCH ACTIVITY

In the second year of my Ph.D. I focused on the commissioning activities of Advanced Virgo Plus (AdV+) at EGO-VIRGO site and on the optical design and test of components (in the Genoa laboratory) for the EPR experiment.

Concerning the commissioning activities, in the first part of my Ph.D. I collaborated with EGO opticians in the assembly and test of two low-losses Faraday Isolators which were then installed in two detection squeezing benches. These Faraday isolators allow to have large extinctions of retro-reflected beams and low losses in the optics involved. Then, I collaborated in the controls development with ACL codes: control loops in order to stabilize the relative phase between two beams on the homodyne detector; automatic-alignment loops using dither lines techniques.

Concerning the EPR experiment, I collaborated in the development of the optical design, in particular in the study of the necessary optics, then starting to install the setup at the EGO-VIRGO 1500W laboratory. I tested the SHG cavity at the Genoa laboratory, where I replaced the previous setup adding a new driver laser in order to have less noise to implement Pound-Drever-Hall technique.

The next steps will be to complete the commissioning activities at EGO-VIRGO site in preparation for O4 run and to proceed with the completion of the setup for the EPR experiment, previously testing some fiber techniques at the Genoa laboratory.

#### COURSES/EXAMS/SCHOOLS

- I attended the following course “Introduction to High-Energy Astrophysics”(F. Tavecchio). Exam scheduled shortly.
- I attended the “SIGRAV International School 2021: Gravity of Compact Astrophysical Objects and Gravitational Waves” on February 1<sup>st</sup>-5<sup>th</sup> (webpage: <https://agenda.infn.it/event/23750/>)

#### PUBLISHED ARTICLES/CONFERENCES

- B. Garaventa et al. (Virgo Collaboration), “Automated source of squeezed vacuum driven by finite state machine based software”, The Review of Scientific Instruments, DOI:10.1063/5.0046317 (May, 2021)

- B. Garaventa et al., “A Recent Study on Frequency-dependent Squeezing Generation with EPR Entanglement”, In book: New Insights into Physical Science Vol. 11 Chapter 10, Book Publisher International (January, 2021)
- I gave an oral talk, with a ppt presentation, during the Virgo Week (April 20<sup>th</sup>)
- I will participate in the European Researchers' Night (Sharper) with an oral talk, with a ppt presentation (September, 2021)