



Statement of the
INFN – Italian Institute of Nuclear Physics
and
KAGRA Observatory ICRR The University of Tokyo
about the development of
Third Generation Gravitational Waves detectors

The INFN (Italian Institute of Nuclear Physics) and The University of Tokyo share a long standing and fruitful collaboration in many fields of research, among which the study of neutrino properties by means of solar, atmospheric and accelerator neutrinos, both in Japan and in Italy, and the search of new physics with the Belle-II detector at KEK in Japan.

INFN and the KAGRA Observatory of the Institute for Cosmic Ray Research (ICRR) are also deeply involved in the study of Gravitational Waves (GW), by means of two existing detectors (laser interferometers) in Italy (VIRGO) and Japan (KAGRA).

These detectors, together with the LIGO interferometers in the USA, represent the state-of-the-art of GW technology and will be operated for the next 10-20 years, delivering, very likely, great science. However, to further improve our knowledge of the universe and of the fundamental laws of gravitation by means of GW, a new generation of more capable and more powerful telescopes is necessary. The activity to design and build as soon as reasonably possible such a new telescope has already begun.

The Einstein Telescope (ET) project in Europe is a proposal to build a third-generation double interferometer that will enhance the sensitivity by more than a factor 10, increasing the observation volume by a factor 1000 and covering, therefore, essentially the whole observable universe, back in time when stars and galaxies did not exist yet.

ET will require underground cryogenic interferometers along the same line pioneered by the KAGRA detector, making a direct collaboration between INFN and KAGRA scientists timely and extremely desirable.

INFN and KAGRA Observatory agree therefore to collaborate in the development of new technologies necessary to cool the key elements of the instruments to very low temperature, a

problem that the KAGRA scientists are already facing and that will need to be developed further to reach ET sensitivities.

The cooperation will include the sharing of knowledge, ideas, technologies and the common developments of new techniques.

On INFN side, two new laboratories, currently under construction in Italy (Roma and Perugia) will be involved in the activities, together with many young scientists and engineers recently hired for that purpose.

On the KAGRA Observatory side, the activity will focus on improving the KAGRA interferometer including the cryogenic mirror system. The accumulated knowledges on them will be commonly shared with the whole ET scientists.

The activity will begin within 2024 and will continue for three years, possibly to be continued and further strengthened in the future.

We are convinced that the common effort will enhance the already significant collaboration between our institutes and will pave the way to the development of some of the many new technologies that Einstein Telescope and other 3G GW interferometers call for, also considering that the full exploitation of the science reach of 3G detector will require a global multi-messenger and multi-national approach.

June 21st, 2024

For KAGRA Observatory, ICRR:

Shinji Miyoki, Director of KAGRA Observatory, ICRR, The University of Tokyo



Takaaki Kajita, Distinguished University Professor (ICRR), The University of Tokyo



For INFN:

Antonio Zoccoli, President of INFN