

# Memorandum of Understanding for establishing the Global Neutrino Observatory, Phase-I (Global Neutrino Network)

## Preamble

The idea to form a Global Neutrino Observatory (GNO) has been discussed in the international community of high-energy neutrino astrophysicists for several years, resulting in a Letter of Intent (LoI). The LoI has been endorsed by the institutional boards of the participating collaborations (listed below). The first step toward establishing the GNO (and the subject of this MoU) is the creation of Phase-I of GNO, a Global Neutrino Network (GNN). GNN has the goal of developing a coherent strategy to maximize the synergistic effects of exchanging information, analysis methods and scientists, of cross-checking results, and of defining common ways of presenting data. GNN is also intended to facilitate preparation of Phase-II, which will include future detectors of similar scale in both the Northern and Southern Hemispheres. From a physics point of view, the future Phase-II can be seen as a single infrastructure with detectors distributed over several continents. GNN is a consortium of independent collaborations.

## Membership

The initial partners of the GNN are four collaborations operating or constructing underwater or ice neutrino telescopes. In alphabetic order, they are:

**ANTARES:** The ANTARES collaboration operates a neutrino telescope of about  $10^7$  m<sup>3</sup> volume in the Mediterranean Sea close to Toulon, France. The ANTARES detector has proven the feasibility of constructing and operating deep-sea neutrino telescopes.

**Baikal:** The Baikal collaboration operates a small neutrino detector of about  $10^5$  m<sup>3</sup> volume in Lake Baikal, which pioneered the field in the 1990s, and is in the prototyping/early construction phase for a telescope of cubic-kilometer scale.

**IceCube:** The IceCube collaboration operates a cubic-kilometer neutrino telescope at the South Pole and is presently discussing possible extensions to address physics at energies beyond the original design goals.

**KM3NeT:** The KM3NeT collaboration has emerged from the projects ANTARES, NESTOR and NEMO. The project aims at a distributed infrastructure in the Mediterranean Sea with a total volume of several cubic kilometers. It is in the first construction phase.

## Aims of GNN

GNN aims for a closer collaboration and a more coherent strategy among the four neutrino telescope communities, resulting in significant synergistic effects and benefits for each individual project to pursue its science goals. It will serve as a forum for formalizing and further developing the present annual *Mediterranean-Antarctic Neutrino Telescope Symposium* (MANTS) meetings and biannual international workshop on *Very Large Volume Neutrino Telescopes* (VLVNT).

The primary goals of GNN are:

- to organize schools and topical workshops, specifically the MANTS meetings and VLVNT conferences,
- to provide a forum for exchanges and consultation between the partners,
- to work toward a framework for coordination of cooperative actions and self-organization of the neutrino astronomy community,
- to establish a common legacy of public documents that would form the foundation of the field (like Technical Design Reports, VLVNT proceedings, etc.),
- to create an annual award for an outstanding PhD thesis,
- to create a public web page,
- to stimulate joint outreach activities,
- to coordinate relations with other fields of science, such as particle physics, astrophysics, environmental sciences, geosciences, marine biology and oceanography, and glaciology, and
- to prepare a foundation for even closer future cooperation, the GNO.

GNN would encourage the formation of cooperative projects directed at the most effective use of our infrastructures by facilitating the combination of experimental data to achieve more reliable results and to further increase the sensitivity beyond that of individual detectors. These projects may include:

- combinations of sky maps,
- cross-checks of results with different systematics,
- coordination of alert and multi-messenger policies,
- exchange and mutual checks of software,
- creation of a common software pool,
- standards for data representation,
- exchange of expertise through mutual working visits of scientists and engineers, and
- exchange of expertise by forming ad-hoc advisory committees of members of the four participating collaborations, if requested by a participating party; this may generate better

understanding of data, optimization of future detector configurations, or technological solutions for the next generation arrays.

### **GNN Board**

The coordination of GNN activities will be handled by a GNN board. This board will have regular phone calls. At least once per year, board members will meet face-to-face. Phone calls and meetings will be documented in written minutes. Recommendations/decisions of the GNN board will require endorsement by the collaborations.

The GNN board will be responsible for finding the resources for facilitating administrative support, needed to prepare meetings, teleconferences, and schools; manage bookkeeping of the various activities; help coordinate the exchange program; and maintain the web page. Support will also be sought for exchange programs for young scientists.

### **Confidentiality**

GNN does not foresee exchange of any confidential information beyond what is already common practice.

### **Publications and Authorship**

The standard procedures for publication will remain as they are for a single partner who analyses its own data. If a particular analysis relies to a significant extent on non-published software or methods developed by other GNN partner(s), an agreement on how to handle publication procedures will need to be made in consultation with the concerned GNN partners prior to publication. It is the responsibility of the GNN board to identify and handle such cases.

### **Validity**

This document will be valid until October 15, 2016 and can be extended. It will be reviewed for proposed amendments as necessary. Any partner may bring such proposals for amendments to the board's attention. A 2/3 majority of the board is necessary to pass an amendment. Amendments, like other decisions, require the ratification of the participating collaborations.

Signed by:

For the Antares collaboration:



Prof. Paschal Coyle, Marseille  
(ANTARES Spokesperson)



Prof. Juan-Jose Hernandez-Rey, Valencia  
(ANTARES Deputy Spokesperson)

For the Baikal collaboration:



Prof. Grigorij Domogatsky, Moscow  
(Baikal GVD Spokesperson)



Prof. Zhan-Arys Dzhilkibaev, Moscow  
(Baikal GVD Deputy Spokesperson)

For the IceCube collaboration:



Prof. Olga Botner, Uppsala  
(IceCube Spokesperson)



Prof. Tyce DeYoung, University College  
(IceCube Deputy Spokesperson)

For the KM3NeT collaboration:



Prof. Maarten de Jong, Amsterdam  
(KM3NeT Spokesperson)

Prof. Mauro Taiuti, Genova  
(Chairperson Institutional Board)



October 15, 2013. München. MoU signing.

From left to right: **Christian Spiering, Maarten de Jong, Tyce DeYoung, Zhan.-Arys Djilkibaev, Juan-Jose Hernandez-Rey, Paschal Coyle, Olga Botner, Uli Katz.**