Letter of Intent

**Please specify an acronym, a project title and the name(s) of the project leader(s)**

**GATE- Gamma-ray Arrays Traveling for the European community**

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**In the sections below, please provide details on** *(2 pages max.):*

**1. Research objectives**

This proposal tackles the challenge of providing an expertise on an optimal utilisation of experimental setups for nuclear spectroscopy and nuclear reactions communities in order to address some of the scientific topics covered by the ALFA Letter of Intent (LoI). Large research collaborations in these two fields are investing significant efforts and resources in developing new instrumentation (such as, e.g., AGATA) experimental methods and techniques for semiconductor and scintillator detectors, for front-line research at the various research centres and universities across the world. Several of these techniques are of common interest and the effective exchange of information in addition to the pooling and maintaining of resources will be of great benefit to the whole research community working at all facilities. The coordinated effort of different collaborations centred around detectors and experimental resources that can travel and be shared among the infrastructures of various European laboratories for an optimal time period will largely enhance the quality and the scientific output of the experimental programs and globally improve our knowledge of nuclear structure in a coordinated way. Moreover, the optimal services for the travelling detectors, including a crucial training of new experts on the state-of-art detector technology, digital electronics and FPGA pre-processing, as well as Machine Learning, could be provided.  This will guarantee a long-term availability of the existing resources and the future development of the field." In this way, the gamma-ray spectroscopy and nuclear-reaction communities will remain competitive at the global level. Contemporary instrumental In-Flight and ISOL set-ups for nuclear physics involve the development of large angular coverage systems comprised of inorganic scintillator detectors for ion calorimetry, spectroscopy & timing measurements. With these systems the development of novel Pulse Shape Analysis discrimination and processing methods is necessary to maximise their performance. Also, gas and semiconductor silicon detectors (e.g. Double-Sided Silicon Detectors) are used for position determination and particle identification, timing and tracking within the fragment separators and magnetic spectrometers. This LoI relates to the INTRANS project within the EUROLABS, which resulted in significant enthusiasm from the nuclear physics community including several new ideas for the field in general. As a consequence, the field requires further discussions at the European level. The new ideas include wide range of AI applications to optimize the design of novel detectors and electrodes along with intelligent processing of data to facilitate faster analysis. The development of neuromorphic detector designs could allow for optimization towards several challenging niches, such as improved position and timing resolution or more efficient electrode placement for cost-effective detectors.

**The work will contain several tasks:**

**TASK 1:** Efficient use of the flagship European spectroscopy resources at the different infrastructures, focusing on maximizing their effectiveness, as well as coordination of the experimental campaigns at the various infrastructures providing and exchanging information on their potential opportunities.

For this task, we propose to organize annual meetings between the management of the nuclear spectroscopy collaborations and the directorate of the hosting infrastructures to ensure the best exploitation of the opportunities provided by the different infrastructures; to coordinate timelines and optimise the distribution of the resources for physics campaigns. We also offer our services for the organization of workshops to discuss physics opportunities and perspectives for the future of the field.

**Budget:** 3 x 20 kEuros

**TASK 2:** Training in nuclear spectroscopy techniques

**Subtask 2.1:** Organization of training courses for new and more experienced users. The courses will cover the most important and useful subjects and techniques for nuclear spectroscopy, from hardware aspects to software tools, data access and management as well as data-analysis techniques of relevance to the investigation of the physics topics of interest.

**Budget:** 3 x 15 kEuros

**Subtask 2.2:** Organization of hands-on workshops for experienced scientific and technical staff. These workshops allow the experts in detector technologies to share their knowledge and expertise, reducing the risk of exposure by the retiring experts. Such a dissemination of information will benefit the physics campaigns of the community of ~500 spectroscopists.

**Budget:** 3x 15 kEuros

**TASK 3**: Sharing of technological expertise and transfer of knowledge through the exchange of technical experts between infrastructures and research institutions, with special emphasis on High Purity Ge detector maintenance and repair.

**Budget**: 70 kEuros

1. **Connection to Transnational Access infrastructures (TAs) and / or Virtual Access projects (VAs)**

Several research infrastructures with transnational access are addressed to facilitate the realization of the various tasks: CERN-ISOLDE, GSI-FAIR, ALTO-GANIL, LNL-LNS, JYFL, ELI-NP/IFIN-HH, NLC consortium (Warsaw-Krakow), ....

**3. Estimated budget request**

Total cost of 220 kEuro, distributed as described above, will be requested.

**4. Participating and partner institutions**

List of partner Institutes: GANIL, IJCLab, GSI/FAIR, LNL-LNS, University of Liverpool, IFIC Valencia

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