ID de Contribution: **11** Type: **contribution**

Search for New Physics beyond the Standard Model with precision measurements in nuclear beta decays

Nuclear Physics has played a major role in establishing the laws of physics at the most fundamental level and in shaping the Standard Model of elementary particles (SM). Notable examples include the discovery of maximal violation of spatial inversion symmetry, *P*, the left-handed vector axial-vector (*V-A*) nature of the weak interaction and the conservation of the vector current. Today, the SM still leaves open questions such as the masses of neutrinos, the nature of dark matter, the baryon asymmetry etc···and most efforts are dedicated to the search for New Physics (NP), i.e observations that would reveal deviations from the SM predictions. This search is a strong motivation for experiments carried out both at the high energy frontier, with the most powerful particle colliders, and at the precision/intensity frontier, in low energy processes such as beta decay. A recent theoretical approach, based on effective field theories, enables a relevant comparison between results obtained at low and high energies highlighting their complementarity at a given level of precision. The development of new and always more advanced technologies suggests that unprecedented precisions should be reached in future low energy measurements, which require the control of systematic effects at equivalent levels of precision. Analysis and interpretation of results must also include higher order effects which have thus to be determined or computed with the appropriate accuracy. In this context, key experiments, a large part of which could be performed during the next decade with specific nuclei and using well defined experimental methods, can be identified. The projects and experiments carried out by French laboratories involved in the field focus on three specific topics summarized in this contribution.

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Classification de Session: Contribution to the future of GANIL