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# The Super Separator Spectrometer (S3) for the very high intensity beams of GANIL/SPIRAL2

The Super Separator Spectrometer S3 [1] is being developed as part of the SPIRAL2 facility at GANIL. S3 has been designed to extend the capability of the facility to perform experiments with radioactive nuclei produced with extremely low cross sections, taking advantage of the very high intensity stable beams of the superconducting linear accelerator of SPIRAL2. The focus of S3 physics is the study of nuclei from medium-heavy mass at the proton drip line up to the super-heavy elements produced by fusion-evaporation reactions, by investigating the properties and the decays of their ground and isomeric states. The common feature of these research programmes is the need to separate very rare events from intense backgrounds. The development of S3 required the solution of two major technological challenges: the need for very intense heavy-ion beams to access reactions with very low cross-sections (picobarn and below) and the need for a powerful recoil separator-spectrometer that can combine, thanks to its innovative superconducting multipole magnets, a large transmission with a high selectivity and the capability to perform in-flight mass-number determination of short-lived nuclei.
The interest of the S3 physics is that the nuclear chart can be studied by different approaches depending on the experimental set-up placed at the end of the spectrometer. The S3 project, considered as a "radioactive nuclei production facility", has motivated the development of a wide range of innovative instrumentation setups, aiming at determining different observables of those nuclei, namely SIRIUS [2] for implantation-decay spectroscopy of super-heavy elements and the Low Energy Branch [3-4] for laser and decay spectroscopy, and mass spectrometry.
S3 is presently in the final stages of installation and commissioning has begun. We will present the scientific objectives of S3, the current status of the facility and the different stages of commissioning.

[1] F. Déchery et al., Eur. Phys. J. A 51, 66 (2015)
[2] J. Piot and the S3 collaboration, Acta Phys. Pol. B 43 (2012) 285
[3] J. Romans, et al., Atoms 10(1), 21 (2022)
[4] A. Ajayakumar, et al., Nucl. Instrum. Meth. B 539, 102 (2023)

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## Classification

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