

PhD position in nuclear instrumentation

SHELA (Super Heavy Element LAsER spectroscopy at GSI and GANIL)

GSI Helmholtz Centre for Heavy Ion Research in Germany, Darmstadt, and GANIL Grand Accélérateur National d'Ions Lourds in France, Caen, have a common interest in developing laser spectroscopic instrumentation to measure nuclear hyperfine interactions of actinide and trans-actinide isotopes.

Laser spectroscopy is a powerful and precise tool to measure atomic levels and their hyperfine structure, revealing atomic and chemical properties, in addition to information on the shape and the size of the atomic nuclei.

Elements above the actinide element fermium (100 protons), known as super-heavy elements, lack such information and therefore their atomic structure information relies on atomic theory calculations. Here, experimental investigations are needed to validate modern atomic theory calculations of such heavy and highly correlated atomic systems. In particular, for the element Lr (with 103 protons), the last member of the actinide series, the atomic ground state configuration has not yet been confirmed unambiguously by any experiment, calling for experimental investigation at the highest sensitivity.

The super heavy elements physics research section at GSI has a leading role in experiments of laser spectroscopy experiments of the heaviest elements. Here, the RADRES (Radiation Detected Resonance Ionization Spectroscopy) technique [1], based on in gas cell laser spectroscopy, has been employed for several years in pioneering experiments on Fm-No isotopes. At GANIL, the S3 (Super Separator Spectrometer) Low Energy Branch, S3LEB, is currently under construction as part of the SPIRAL2 facility. In the near future, it will become a new-generation source of new and pure radioactive ion beams at low energy, in particular of super-heavy elements.

In these two complementary facilities, techniques for laser spectroscopy in a gas-jet, aiming at an improved spectral resolution [2], are under construction and show a large overlap in the required technical developments.

To strengthen the synergy of the two institutes in this topic, a PhD position - shared between GSI and GANIL - is proposed. The PhD candidate will contribute to the common developments, in particular on the production and characterization of a supersonic gas jet and on the optimization of the gas cell behavior at the super-heavy element spectrometer of GSI. He or she will also participate in experiments for the investigation of actinides and transactinide spectroscopy by resonance- ionization laser spectroscopy. Finally, he or she will participate to the commissioning of the S3LEB set-up at GANIL with emphasis for the heavier elements. The position will be shared between Darmstadt and Caen.

[1] Nature 538, 19345 (2016)

[2] Nature Communications 8, 14520 (2017)

Expected skills:

Good knowledge in nuclear and atomic physics, photonics, ion optics, instrumentation, and computing is desirable

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