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Sub-barrier fusion cross section measurements with STELLA

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The STELLA (STELlar LAboratory) experimental station for the measurement of sub-barrier light heavy ion fusion cross sections has been commissioned at the Androm\'{e}de accelerator at IPN, Orsay. These measurements can yield both insight into nuclear cluster effects~[1] and the S-factors at energies of astrophysical interest. In particular, ^{12}C+^{12}C fusion was identified as a key reaction on the production route of heavier elements in massive stars during the carbon burning phase, in type Ia supernovae and in superbursts from accreting neutron stars~[2].

Since sub-barrier fusion reactions are strongly hindered by Coulomb repulsion, the experimental determination of these cross sections ($\sim$~nb) is highly challenging. Nowadays, the determination of such cross sections is targeted with coincidence measurements using the so called gamma-particle-technique~[3]. The STELLA setup comprises a set of DSSSDs as well as an array of $LaBr_3$ detectors from the UK FATIMA collaboration (FAst TIMing Array) for charged particle and gamma recognition, respectively. In addition, a rotating target mechanism is developed to sustain beam intensities $> 10\mu$A.

In this contribution, the experimental layout will be introduced in detail with a focus on the design and performance of $LaBr_3$ detection array. Furthermore, the measurement technique will be sketched with first results from the commissioning campaign using ^{12}C beam.

[1] D.~Jenkins and S.~Courtin, Phys. Jour. G 42, 034010 (2015);
[2] L.R.~Gasques \textit{et al.}, PRC 76, 3, 035802 (2007);
[3] C.L.~Jiang \textit{et al.}, NIM A 682, 12 (2012);

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