## Towards background-free studies of capture reactions in a heavy-ion storage ring

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Stored and cooled highly-charged ions offer unprecedented capabilities for precision studies in the realm of atomic-, nuclear-structure and astrophysics [1]. After the successful investigation of the cross section of the <sup>96</sup>Ru(p, $\gamma$ )<sup>97</sup>Rh reaction in 2009 [2], the first measurement of the <sup>124</sup>Xe(p, $\gamma$ )<sup>125</sup>Cs reaction cross section was performed at the Experimental Storage Ring (ESR) of GSI [3] in 2016. The experiment has been performed with decelerated fully-ionized <sup>124</sup>Xe ions. Using Double Sided Silicon Strip Detectors (DSSSD), introduced directly into the Ultra High Vacuum environment of the storage ring, the <sup>125</sup>Cs proton-capture reaction products of interest have been successfully detected. The cross sections are measured at 5 different energies between 5.5 AMeV and 8 AMeV, on the high energy tail of the Gamowwindow for hot, explosive scenarios such as supernovae and X-ray binaries. The well-understood atomic REC cross section for <sup>124</sup>Xe+H<sub>2</sub> reaction is used for luminosity calibration.

Elastic scattering on the H<sub>2</sub> gas jet target is the major source of background. Monte Carlo simulations show that an additional slit system in the ESR in combination with the energy information of the Si detector will make background free measurements of the proton-capture products possible. The corresponding hardware is being prepared. It will tremendously increase the sensitivity of the method.

[1] F. Bosch et al., Prog. Part. Nucl. Phys.73, 84 (2013)

[2] B. Mei et al., Phys. Rev. C92 035803 (2015)

[3] J. Glorius et al., Phys. Rev. Lett. 122, 092701(2019)