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Prospects of nuclear astrophysics at storage rings

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Most of the time, stars gain their energy from fusion of the very light left-overs of the Big Bang into heavier elements over long periods of time. The observation of radioactive isotopes in different regions of the Universe is an indicator of this ongoing nucleosynthesis. In addition, short-lived nuclei are often intermediate steps during the nucleosynthesis in stars.

A quantitative analysis of these relations requires a precise knowledge of reaction cross sections involving unstable nuclei. The corresponding measurements are very demanding and the applied techniques therefore manifold. The reward, however, is surprisingly huge. It is possible to constrain basic parameters as the age of the Universe, temperature and convection times in stars, or neutron densities during explosions.

Ion storage rings offer unprecedented possibilities to investigate radioactive isotopes of astrophysical importance. I will present recent experiments and ideas for future setups. The experiments cover neutron- and proton-induced reactions as well as beta decays. The astrophysical scenarios range from small, compact objects like neutron stars to huge Red Giants.

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