

ExtreMe Matter Institute EMMI

EMMI Featured Talk / GSI Colloquium

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Nuclear Physics and Colliding Neutron Stars: The Origin(s) of Gold in the Universe?

The report on "Connecting Quarks to the Cosmos" identified eleven of the most challenging open questions for all of physics in the 21st century. One of these eleven questions included the identification of the site(s) for the production of the heaviest elements found in nature. How were elements Fe to U made?

Most of the elements above Fe in the periodic table are thought to have been produced by either the slow (s-process) or rapid (r-process) capture of neutrons in astrophysical environments. The s-process proceeds close to stability and astrophysical sites have been identified, while the r-process allows the production of nuclei much further from stability and potential sites remain mostly unresolved.

The recent observation of gravitational waves from two neutron star mergers simultaneously with the spectroscopy showed lines from rare earth elements. The questions remain: are there enough such mergers? are mergers the only source of r-process elements?