The unreasonable weakness of r-process cosmic rays in the neutron-star-merger nucleosynthesis scenario

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KK and Kunihito Ioka, ApJ 827 83 (2016)

Main idea of this work

Neutron star mergers eject neutron-rich material

- The ejecta synthesize r-process elements
- The ejecta collide with the interstellar medium

"r-process cosmic rays" could be accelerated

- can we learn acceleration physics?
- can be used to discriminate r-process origins?

Ejecta properties differ between supernovae and neutron star mergers – r-process cosmic rays too?

Our finding

If the neutron star merger is the origin of r-process elements, r-process cosmic rays could be 100 times stronger than for the supernova case

- the ejecta velocity is higher by a factor of 10
- the ejecta energy is higher by a factor of 100

However, observations do not show such selective enhancement of r-process cosmic rays

Acceleration of r-process elements at the merger-ejecta reverse shock is very severely constrained

Limit on acceleration efficiency

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