SNR G39.2-0.3, an hadronic cosmic rays accelerator

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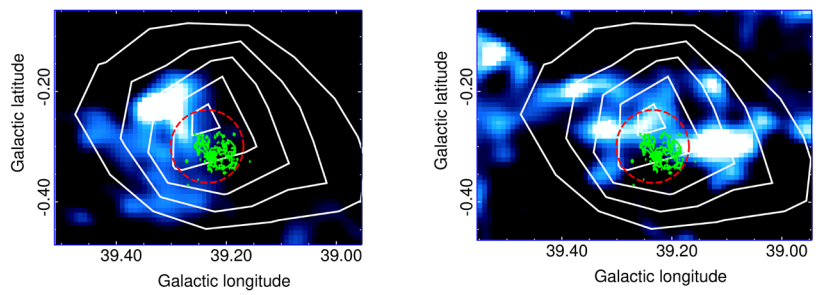
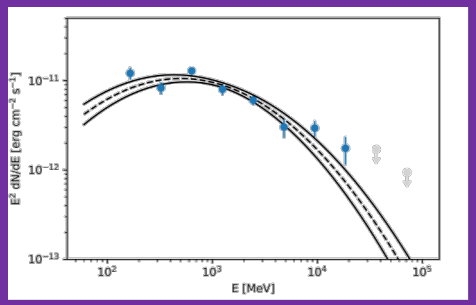
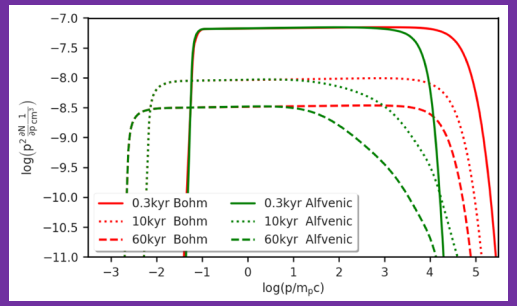


- Fermi-LAT spectrum strongly suggests a hadronic scenario
- Interaction with a dense molecular cloud
- Core-collapse SNR with most likely red supergiant progenitor
- Gamma-ray spectrum compatible with a dynamically old SNR dominated by the escape of cosmic rays



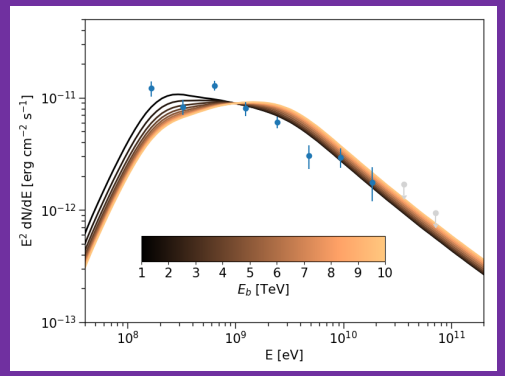
Observations: compatible with a power-law proton spectrum with the spectral index 2.75

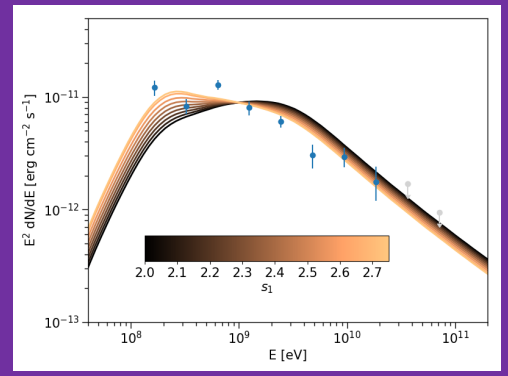
Brose et al. 2020; focus on green lines



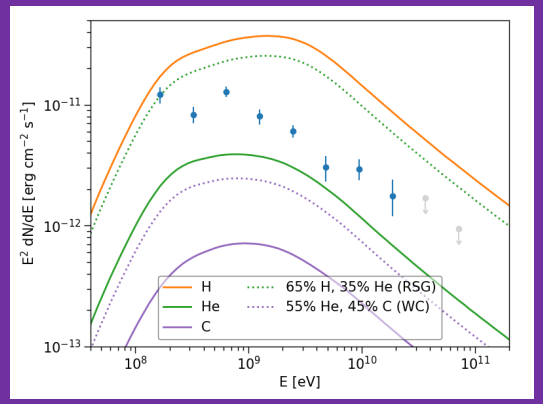
Simulations (Brose et al. 2020, Celli et al. 2019): decrease of the maximum energy + CR escape form a broken power-law spectrum with $s \sim 2.7$ above the break energy which corresponds to maximum energy attainable in acceleration at present time

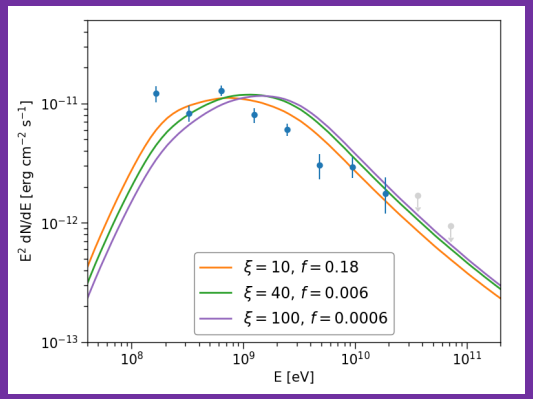
To explain the observed gamma-ray spectrum we either need a very low break energy of ≤ 3 GeV or soft acceleration spectrum with $s \geq 2.3$





Heavy composition of CRs can help with low break energy – the peak of the resulting gamma-ray spectrum shifts to lower energies for heavier particles (need a WR win composition)





Alternative explanation – compression of Galactic CRs – **DOES NOT** work due unrealistically large size of the shell that is needed to match the spectrum