ID de Contribution: **3** Type: **Non spécifié**

Can superbubbles accelerate PeV protons?

mercredi 2 mars 2022 10:00 (45 minutes)

The local cosmic ray spectrum as well as recent gamma-ray observations suggest the existence of galactic sources able to accelerate protons up to at least several PeV, if not tens of PeV. However, these sources are still to be identified. In particular, standard scenarios of particle acceleration, e.g. at supernova remnant shocks around isolated massive stars, struggle to reach PeV bands. On the other hand, most massive stars are not isolated but rather clustered. Clustered stars heat their surrounding medium, which inflates a low-density cavity called a superbubble. After a few Myr, this cavity reaches a size of the order of 100 pc. In the cavity, the stellar feedback is believed to create multiple shocks, strong turbulence, and to amplify the magnetic fields. These are ideal conditions for particle acceleration. In particular, superbubbles have long been thought to be able to accelerate PeV protons. However, the question of the relevant acceleration mechanism is still open.

In this talk I estimate the maximum energy of protons accelerated within superbubbles, considering a number of detailed scenarios. The most promising systems to accelerate PeV protons are the supernovae exploding within compact clusters and evolving in a medium strongly affected by the stellar winds.

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