

Plan Overview

A Data Management Plan created using DMPTool-Stage

Title: FRG20-S: Cosmic-Ray Acceleration Based on Cyclotron Auto-Resonance

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Project abstract:

A Zevatron is an accelerator scheme envisaged to accelerate particles to ZeV energies ($1 \text{ ZeV} = 10^{21} \text{ eV}$). Schemes, most notably the internal shock model, have been proposed to explain the acceleration of ultra-high-energy-cosmic-ray (UHECR) particles detected on Earth since 1962. Here, the cyclotron auto-resonance acceleration (CARA) mechanism is tailored and used to demonstrate acceleration of particles ejected as a result of violent astrophysical processes such as the merger of a binary system or a supernova explosion. Such events result in emission of highly-energetic particles and intense beamed radiation. In the simultaneous presence of a super-strong magnetic field, the condition of cyclotron auto-resonance may be met. Thus CARA acts like a booster accelerator for particles pre-accelerated inside their progenitor by shock waves, possibly among other means. As examples, it is shown here that nuclei of hydrogen, helium, and iron-56, may reach ZeV energies by cyclotron auto-resonance acceleration, under which conditions the particles, while gyrating around the lines of an ultra-strong magnetic field, also surf on the waves of a super-intense radiation field. It is shown here, too, that the ZeV energy gained by a particle does not fall by more than an order of magnitude if the resonance condition is missed by (1-2)%.

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Mathematica codes and figures.

Digital.

No access concerns.

Data will be shared by email and online shared workspace.

Network Drive.

No.
