Contribution ID: **1388** Type: **Talk**

Anisotropy of Cosmic Rays and Chaotic Trajectories in the Heliosphere

Friday 16 July 2021 19:18 (12 minutes)

As cosmic rays (CRs) propagate in the Galaxy, they can be affected by magnetic structures that temporarily trap them and cause their trajectories to display chaotic behavior, therefore modifying the simple diffusion scenario. When CRs arrive at the Earth, they do so anisotropically. These chaotic effects can be a fundamental contributor to this anisotropy. Accordingly, this requires a comprehensive description of chaos in trapping conditions since it is necessary to assess their repercussions on the CR arrival directions. This study utilizes a new method described in López-Barquero & Desiati(2021) to characterize chaotic trajectories in bound systems. This method is based on the Finite-Time Lyapunov Exponent (FTLE), a quantity that determines the levels of chaos based on the trajectories' divergence rate. The FTLE is useful since it adapts to trapping conditions in magnetic structures or even propagating media changes.
Here, we explore the effects that chaos and trapping can have on the TeV CR anisotropy. Concretely, we apply this method to study the behavior of CRs entering the heliosphere. Specifically, how the distinct heliospheric structures and CR impinging directions from the ISM can affect chaos levels.
The heliosphere has an intrinsic directionality that affects CRs differently depending on where they enter it. This feature causes preferential directions from which particles tend to be more chaotic than others. This eventually translates into changes in the arrival maps which are not uniformly distributed. Instead, we expect sectors in the map to change separately from others, creating a time-variation that could be detected. Consequently, this result points to the idea that time-variability in the maps is essential to understanding the CR anisotropy's overall processes.

Keywords

Anisotropy; heliosphere; chaos; trapping; confinement; magnetic fields; MHD; solar wind; energetic particles; magnetic mirror; propagation; heliospheric; chaotic; cosmic rays; maps;

Collaboration

other Collaboration

Subcategory

Theoretical Methods

Primary authors: LÓPEZ-BARQUERO, Vanessa (Wisconsin IceCube Particle Astrophysics Center); DESIATI, Paolo (University of Wisconsin - Madison)

Presenter: LÓPEZ-BARQUERO, Vanessa (Wisconsin IceCube Particle Astrophysics Center)

Session Classification: Discussion

Track Classification: Scientific Field: SH | Solar & Heliospheric