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Phenomenology of CR-scattering on pre-existing MHD modes

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We present the phenomenological implications of the micro-physics of cosmic-ray (CR) diffusion as resulting from particle scattering onto the three modes in which *Magneto-Hydro-Dynamics* (MHD) cascades are decomposed. We calculate the diffusion coefficients from first principles based on reasonable choices of the physical quantities characterizing the different environments of our Galaxy, namely the *Halo* and the *Warm Ionized Medium*, and implement for the first time these coefficients in the DRAGON2 numerical code. Remarkably, we obtain the correct propagated slope and normalization for all the charged species taken into account, without any *ad-hoc* tuning of the transport coefficients. We show that fast magnetosonic modes dominate CR confinement up to $\sim 100\,\mathrm{TeV}$; Alfvénic modes are strongly subdominant due to the anistropy of the cascade (in agreement with previous findings) up to rigidities in the sub-PeV domain, where their contribution may show up as a spectral feature, potentially observable in the upcoming years. We also find that such framework cannot be responsible for CR confinement below $\sim 200\,\mathrm{GeV}$, possibly leaving room for an additional confinement mechanism, and that the Kolmogorov-like scaling of the B/C ratio cannot be reproduced. Therefore this scaling might not be the imprint of the pre-exisiting turbulence spectrum.

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Collaboration

other Collaboration

Subcategory

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Primary authors: FORNIERI, Ottavio (DESY Zeuthen); GAGGERO, Daniele (IFT); CERRI, Silvio Sergio (Princeton University); DE LA TORRE LUQUE, Pedro (Stockholm University); GABICI, Stefano (APC Paris)

Presenter: FORNIERI, Ottavio (DESY Zeuthen)

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