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The Influence of Turbulence on the Transport of Energetic Particles

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We explore the influence of magnetic turbulence on the transport of energetic particles, mainly cosmic rays, by using test-particle simulations. We compute parallel and perpendicular diffusion coefficients for two-component turbulence, isotropic turbulence, a model based on Goldreich-Sridhar scaling, noisy reduced magneto-hydrodynamic turbulence, and a noisy slab model. We have shown that for all considered turbulence models, the diffusion coefficients are similar. They have the same rigidity dependence and only the absolute values of the diffusion coefficients are different. This conclusion is in agreement with recent analytical findings based on the unified nonlinear transport theory indicating that only fundamental properties of turbulence such as the length scales and magnetic fields control the diffusion coefficients. To double-check the validity and accuracy of our numerical results, we use a second test-particle code. We show that both codes provide very similar results confirming the validity of our conclusions.

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