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CRs propagation in turbulent reconnection regions

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Cosmic ray (CR) transport and acceleration are essential for many astrophysical problems, e.g., CMB foreground, ionization of molecular clouds as well as all high energy phenomena. Recent advances in MHD turbulence call for revisions in the paradigm of cosmic ray transport. We use the models of magnetohydrodynamic turbulence that were tested in numerical simulations, in which turbulence is injected at large scale and cascades to to small scales. I shall demonstrate that compressible modes instead of Alfven modes dominate the transport of CRs. I shall introduce a non-linear formalism that extends the Quasi-Linear Theory (QLT) that is routinely used for the purpose. This allows us to avoid the usual problem of 90 degree scattering and enable computation of the mean free path of cosmic rays. The result is supported by recent test particle simulations. Implications for particle transport and acceleration in Solar flare and interstellar medium will be discussed. In addition, I address the issue of the transport of CRs perpendicular to the mean magnetic field and show that the concept of cosmic ray subdiffusion is not applicable in 3D turbulence. As a result, this work provides a formalism that can be applied for CR transport and acceleration in a wide variety of circumstances.