Contribution ID: 1

Angular distribution of energetic particles scattered by strongly anisotropic MHD turbulence: understanding Milagro/IceCube results

Friday, 28 October 2011 11:50 (20 minutes)

Both the acceleration of cosmic rays (CR) in supernova remnant shocks and their subsequent propagation through the random magnetic field of the Galaxy deem to result in an almost isotropic CR spectrum. Yet the MILAGRO TeV observatory and the IceCube discovered sharp (~10 deg)

arrival anisotropies of CR nuclei. We suggest a mechanism for producing such a CR beam which operates en route to the observer. The key assumption is that CRs are scattered by a strongly anisotropic Alfven wave spectrum formed by the turbulent cascade across the local field direction. The strongest pitch-angle scattering occurs for particles moving almost precisely along the field line. Partly because this direction is also the direction of minimum of the large scale CR angular distribution, the enhanced scattering results in a weak but narrow particle excess. The width, the fractional excess and the maximum momentum of the beam are calculated from a systematic transport theory depending on a single scale <i><i-</i> which can be associated with the longest Alfven wave, efficiently

scattering the beam. The best match to all the three characteristics of the beam is achieved at <i>l</i> 1 pc. The distance to a possible source of the beam is estimated to be within a few 100pc. Possible approaches to determination of the scale <i>l</i> from the characteristics of the source are discussed. The beam related

large scale anisotropic CR component is found to be energy independent which is also consistent with the observations. The beam splitting mechanism to explain the combined Milagro and IceCube observations is suggested.

Presenter: Dr MALKOV, Mikhail (University of California, San Diego)

Session Classification: Models and implications of CR anisotropy