Abstract number: S4-550
4. High energy cosmic rays (HE-CR I)

Secondary to Primary Ratios of Nuclei Below z=30 n a Dynamic Spiral-Armed Cosmic Ray Model

Benyamin, David[1], J. Shaviv, Nir[1], Piran, Tsvi[1] and Nakar, Ehud[2]
[1]The Hebrew University
[2]Tel-Aviv University

Over the years, significant effort was devoted to understand cosmic ray propagation in the galaxy from the energy dependence of the secondary to primary ratios in galactic cosmic rays. We develop a fully three dimensional numerical code describing the diffusion of cosmic rays in the Milky Way. This code enables us to explore a model in which a large fraction of the cosmic ray acceleration takes place in the vicinity of galactic spiral arms and that these spiral arms are dynamic. Recently, the analysis of cosmic ray propagation from dynamic spiral arms was shown to have an important imprint on the Boron to Carbon ratio (Benyamin et al. 2014). We showed that the effect of having dynamic spiral arms is to limit the age of cosmic rays at low energies. This is because at low energies the time since the last spiral arm passage governs the Cosmic Ray (CR) age, and not diffusion. Using the model, the observed spectral dependence of the secondary to primary ratio is recovered without requiring any further assumptions such as a galactic wind, re-acceleration or various assumptions on the diffusivity. In particular, we obtain a secondary to primary ratio which increases with energy below about 1 GeV. We extended our previous model by upgrading the spallation network up to Silicon and including the Iron and sub-Iron elements (from Scandium to Nickel) necessary for simulating the sub-Iron to Iron ratio. We show that the latter ratio is consistently recovered with the same model parameters that explain the B/C ratio. We also empirically derive the energy dependent probability for K-capture isotopes by fitting the observed ^{49}Ti/^{49}V and ^{51}V/^{51}Cr ratios.