Contribution ID: **2** Type: **not specified**

Updated Constraints on Pulsar Explanations for Positron Excess

Monday, 16 August 2021 09:15 (15 minutes)

Pulsars - spinning neutron stars that are magnetized – are possible candidates that could explain the large excess in the observed positron fraction - ratio of positrons to electrons plus positrons present in data measurements from the AMS-01, HEAT, and PAMELA collaborations. While these results are in great tension with predictions of secondary productions of cosmic rays in the interstellar medium (ISM), pulsars could be a primary source for the positron excess due in large part to the fact that there is evidence that relatively young and nearby pulsars (within a few kiloparsecs) have very high gamma ray emissions as seen in experiments such as HAWC. This comes from the fact that high energy positrons and electrons are injected into the ISM from pulsars, emitting gamma rays. Therefore, building directly upon previous work done by Hooper, Linden, and collaborators which already proposed that young and nearby pulsars could explain the cosmic ray positron excess, this talk will highlight critical updates that were made to further constrain the deviation from ISM predictions of positron flux contributions by pulsar populations. Several free parameters will be discussed – these parameters constitute the characteristics exhibited by pulsars within a given population which would allow them to contribute the most to the positron flux ratio or positron fraction. In particular, the main parameters explored in the analysis include the efficiency, pulsar birth rate, spin-down time, spectral index, and the beaming radio and beaming gamma ray fractions. The work presented relied upon comparing the pulsar contributions (via Monte Carlo simulations) to AMS collaboration data collected between 2011and 2018 and encompasses analysis carried out for a master's thesis.

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Session Classification: Monday