Contribution ID: **61** Type: **Poster**

The positron density in the intergalactic medium and the galactic 511 keV line

Wednesday 11 September 2013 19:30 (2h 30m)

The 511 keV electron-positron annihilation line, most recently characterized by the INTEGRAL/SPI experiment, is highly concentrated towards the Galactic centre. Its origin remains unknown despite decades of scrutiny. We propose a novel scenario in which known extragalactic positron sources such as radio jets of active galactic nuclei (AGN) fill the intergalactic medium with MeV e+e- pairs, which are then accreted into the Milky Way. We show that interpreting the diffuse cosmic radio background (CRB) as arising from radio sources with characteristics similar to the observed cores and radio lobes in powerful AGN jets suggests that the intergalactic positron-to-electron ratio could be as high as 10^{-5}, although this can be decreased if the CRB is not all produced by pairs and if not all positrons escape to the intergalactic medium. Assuming an accretion rate of one solar mass per year of matter into the Milky Way, a positron-to-electron ratio of only 10^-7 is already enough to account for much of the 511 keV emission of the Galaxy. A simple spherical accretion model predicts an emission profile highly peaked in the central bulge, consistent with INTEGRAL observations. However, a realistic model of accretion with angular momentum would likely imply a more extended emission over the disk, with uncertainties depending on the magnetic field structure and turbulence in the galactic halo.

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Session Classification: Poster Session

Track Classification: High-Energy Astrophysics (includes all cosmic ray physics)