ICRC2015

ICRC
The Astroparticle Physics Conference
34th International Cosmic Ray Conference
July 30 - August 6, 2015
The Hague, The Netherlands

Contribution ID: **356** Type: **Oral contribution**

Astrophysical explanation of AMS-02 electron and positron data and constraints on dark matter contribution

Saturday, 1 August 2015 14:30 (15 minutes)

Electron and positron cosmic rays are one of the most powerful tool for astroparticle physics.
The AMS-02 Collaboration has recently released the electron, positron inclusive and positron fraction spectra measured with an incredible precision.
We performed a combined analysis of the recent AMS-02 data in a self-consistent framework where we theoretically model all the astrophysical components that can contribute to the observed fluxes in the whole energy range.
The primary electron flux has been modeled using the near Supernova Remnants in the Green catalog and a far and smooth component of distant sources.
Electron and positron flux has been derived for all the Pulsar Wind Nebulae of the ATNF catalog with the hypothesis that all the sources shine with the same efficiency and energy spectrum slope.
Finally, we derive the secondary electron and positron fluxes originating from interactions on the interstellar medium of primary cosmic rays, for which we derive a novel determination by using preliminary AMS-02 proton and helium data.
We obtain a remarkable agreement between our various modeling and the AMS-02 data for all types of analysis, demonstrating that the whole AMS-02 leptonic data admit a self-consistent interpretation in terms of astrophysical sources and secondary production.
An exotic contribution to electron and positron cosmic ray spectra could be associated to annihilating dark matter WIMP particles.
We have studied at which extent this extra component could substitue or add to the Pulsar Wind Nebulae contribution and we derive severe constraints on the dark matter particle annihilation cross section.

Collaboration

– not specified –

Registration number following ”ICRC2015-I/”

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Session Classification: Parallel DM03

Track Classification: DM-TH