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中国科学院 博士后研究报告

暗物质间接探测的相关研究

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Some Research on Dark Matter Indirect Detection

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摘 要

暗物质的探测是当今重大科学前沿。暗物质间接探测是寻找暗物质存在的证据和确定暗物质粒子的物理参量（质量，湮灭截面或衰变寿命等）的重要手段。本文利用已经发布的AMS-02宇宙射线数据和实时公开的Fermi-LAT伽玛射线数据等来寻找暗物质的信号和研究暗物质的性质，重点是对一些奇异的能谱结构（例如ATIC/HESS/Fermi-LAT发现的总电子能谱超、PAMELA/Fermi-LAT探测到的正电子超出、ATIC/CREAM/PAMELA发现的宇宙线能谱超出、Fermi-LAT数据中可能的130GeV线谱结构等）进行深入研究，区分/限定暗物质起源与普通天体物理起源，发现暗物质粒子存在的证据或高精度限制物理参

关键词： 暗物质粒子，宇宙线，暗物质间接探测

Abstract

The dark matter detection is hot research subject nowadays. The indirect detection of dark matter particles is an important method to search the evidence for the existence of dark matter and measure the physics parameters of dark matter (such as mass and cross section or lifetimes). This paper plans to search the dark matter signals and study the nature of dark matter particles using the AMS-02 data and Fermi-LAT data. ATIC discovered that there is an excess at about 300 to 800 GeV in the cosmic ray electron plus positron energy spectrum. This discovery was confirmed by Pamela. There are two kinds of models to explain this excess: the existence of dark matter and the existence of astrophysics source. AMS-02 can obtain more cosmic ray events and have higher energy resolution. So AMS-02 provides better measurement of cosmic rays and we can study the origin of the excess. Moreover, it is an important method for the indirect detection of dark matter to find the possible excess in gamma ray observation. Weniger et al find a tentative gamma-ray line at about 130 GeV. We plan to study this signal using more Fermi-LAT data and study the gamma ray point source and so on.

Keywords: Dark Matter Particle, Cosmic Ray, Dark Matter Indirect Detection

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