

ANTIMATTER

Positrons in space

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Credit: NASA/AMS

Positrons are found naturally among cosmic rays. But where do these excess antiparticles come from? The matter–antimatter asymmetry is an enduring cosmic mystery. Positrons could be by-products of

dark matter annihilation, or accelerated by astrophysical objects (plasma jets of black holes or neutron stars) or produced from collisions between cosmic ray nuclei and the interstellar medium (ISM). Previous measurements were not able to discriminate between these models. Now 6.5 years of positron data taken by the Alpha Magnetic Spectrometer (AMS-02) on the International Space Station reveal high-energy behaviour that can help pinpoint their origins.

By observing 1.9 million positrons (out of 107 billion cosmic rays), the AMS Collaboration finds that the energy dependence of the positron flux is very complex. At low energies, the positron flux increases with energy, then flattens from 7.10 to 27.25 GeV and then increases again. In 2014, AMS data suggested a levelling of the flux after about 200 GeV, but now with improved statistics, the collaboration shows a clear maximum at ~290 GeV followed by a sharp decline. Overall, the flux fits a profile with two peaks: a low-energy diffuse term corresponding to positrons from cosmic ray and ISM collisions and a high-energy source term corresponding to dark matter annihilation or astrophysical acceleration. Tracking down the source of those isotropic positrons will take more cosmic ray measurements. The AMS website has recorded 129 billion events and counting ...

 May Chiao

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