

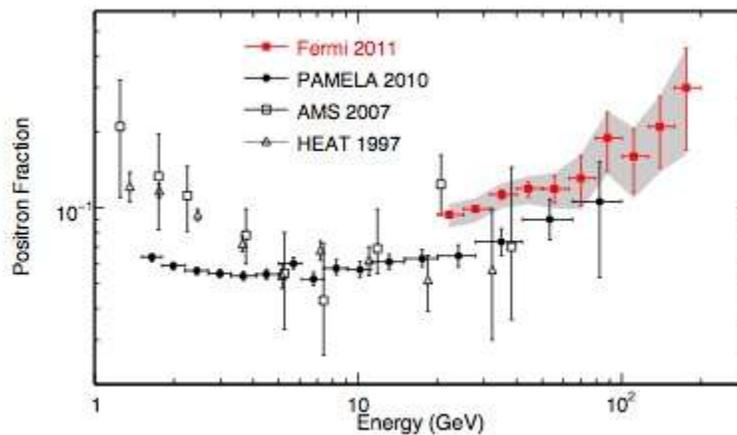
Dark matter retains all its mystery

Monday morning, at the [Moriond conference](#), the most expected talk in the [dark matter](#) session contained unfortunately no results. Although the AMS collaboration was supposed to reveal their very first measurements, Bruna Bertucci could only present apologies to an eager audience since the approval process had not been completed in time for the conference,

The [AMS](#) or Alpha Magnetic Spectrometer is a particle detector that was installed on the International Space Station in May 2011 and has been collecting data ever since. The scientific community is now eagerly waiting to hear about their results, in the hope of getting some clues as to what makes up 24% of all content of the Universe, namely what are the mysterious particles that form dark matter.

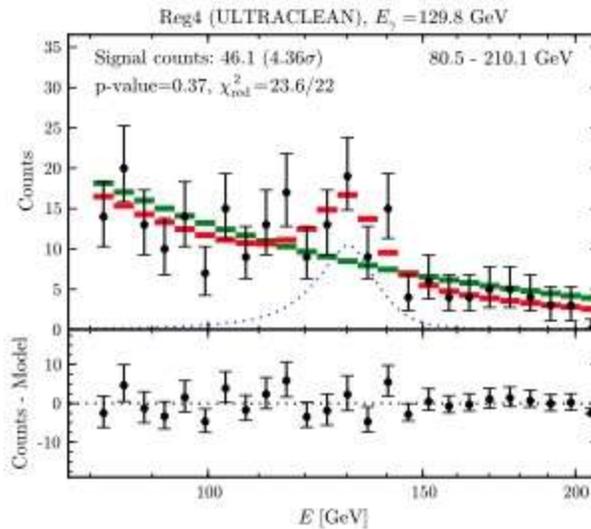
AMS is due to release data that will compare the flux of positrons in outer space with the flux of electrons. Positrons are the antimatter counterpart of electrons. The interest all stems from the fact that a few years ago, the [PAMELA collaboration](#) observed a larger positron flux at high energy than expected. It is relatively easy to think of various sources of electrons since we live in a world made of matter. But what could be a source for antimatter? One possible explanation is to suppose that dark matter particles are annihilating into pairs of electrons and positrons, and hence providing a source of positrons.

Another group operating a satellite-born experiment, the [FERMI-LAT collaboration](#) partially confirmed that observation but only AMS has all the capabilities to really cross-check the PAMELA results. We will have to be a bit more patient until the AMS collaboration publishes with its first results.



The increase in the positron flux with respect to the electron flux as seen by various experiments. The AMS data should bring a definitive confirmation of the excess observed at high energy.

Meanwhile, the FERMI group has work on its hands as explained by Gabrijela Zaharijas since a theorist, Christoph Weniger, analysing data collected by FERMI, detected a signal in the form of a sharp spectral line at 130 GeV – gamma rays of a specific energy – coming from a region in the galactic center. His approach was to look in areas of the galaxy where he expected to find the most dark matter and fewest sources of gamma rays of known origin. He studied five such locations in the center of our galaxy where dark matter is known to be more concentrated. For three of these locations, he found events in excess of the known sources of gamma rays, i.e. more signal than background. The signal was also very strong, four times stronger than possible statistical fluctuations of the background level, that is 4.4 sigma.



The excess of events found by Christoph Weniger in FERMI data seen above the background described by a power law spectrum.

The FERMI collaboration has since improved the data calibration and modeling of energy dispersion, which should have led to an increase in the signal strength. On the contrary, they found the signal got fainter, making them doubt it was a real effect. In fact, while checking a region containing only background (the Earth atmosphere where lots of gamma rays are produced by incoming cosmic rays), they detected a similar “signal”, although fainter at 2.3 sigma. This is not quite enough to explain the anomaly detected in the galactic center but seems to indicate some instrumental error. Further investigations are underway.

We should soon get to the bottom of this story since a new telescope, HESS-2 in Namibia will start observing the galactic center region this month. In less than 50 hours in good operating conditions, they should be able to accumulate enough data to confirm or contradict the presence of this 130 GeV signal.

Will we soon have some hints on the mysterious nature of dark matter? It is well worth a bit more patience in the hope to learn more soon.

Pauline Gagnon

To be alerted of new postings, follow me on Twitter: @GagnonPauline or sign-up on this [mailing list](#) to receive and e-mail notification.

This entry was posted on Tuesday, March 5th, 2013 at 4:23 am and is filed under [Latest Posts](#). You can follow any responses to this entry through the [RSS 2.0](#) feed. You can [leave a response](#), or [trackback](#) from your own site.

<http://www.quantumdiaries.org/2013/03/05/dark-matter-retains-all-its-mystery/>