

UNH to analyze 'bellwether' solar event data from European satellite

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The Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics, or PAMELA, satellite. Credit: PAMELA mission.

When the sun launched a moderate, or M-class, solar flare May 17, 2012, it was still one of the largest eruptions seen since late January when our star began to rouse from an anomalously long quiet period. But the event was not just an additional solar wake-up call; it produced something that has the solar physics community puzzled and scientists from the University of New Hampshire poised to analyze a singular dataset gathered during the event by a European satellite called PAMELA – short for Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics.

The puzzle is this: The solar event created what is known as a ground-level enhancement (GLE), which is a blast of high-energy particles registered by ground stations on Earth after a very large solar flare and/or another explosive mechanism known as a coronal mass ejection (CME). The May 17 GLE lit up ground stations (neutron monitors) all over the world for the first time in nearly six years, but given the stature, or lack thereof, of the solar explosions, there should have been no GLE at all.

Says James Ryan, an astrophysicist at the UNH Space Science Center (SSC) and UNH co-investigator on the PAMELA mission, "This solar flare was most unimpressive and the associated CME was only slightly more energetic. And looking at it optically, it was remarkably dim, it was, all things considered, a ninety-eight pound weakling of solar events."

Enter PAMELA, which as luck would have it "looks" at an energy range of particles not seen by any other spacecraft. The data PAMELA recorded on the May 17 solar event should provide scientists with an unprecedented view of how the high-energy particles morphed through time and space, and this should provide insight into the mysterious appearance of the GLE.

PAMELA is a mission carried out by a European collaboration led by Italy and Russia together with German and Swedish institutes, and collaborators in the U.S. at UNH, New Mexico State University, and NASA's Goddard Space Flight Center. Launched in 2006 and dedicated to studying cosmic rays, just two weeks before the most recent blast from the [sun](#) PAMELA was retasked to focus on solar physics due to the sun's ever-increasing activity.

For decades, there has been strong debate as to what complex processes produce the extremely energetic particles that are registered on the

ground; is it the shockwave in front of a CME or do the particles come from the [solar flare](#) itself? The most recent event has the potential to be a "real bellwether" according to Ryan because it will allow the study of the evolution of the flare from low to high energies without interruption.

"The PAMELA satellite provides us with a bridge that has never existed before," says Ryan, "a bridge between solar energetic particles measured by other spacecraft and those made on the ground by neutron monitors, like the one we've operated here in Durham for decades. Spanning that gap has opened up new opportunities."

The opportunity for Ryan and his SSC colleague Ulisse Bravar, UNH's principal investigator for the PAMELA mission, is to begin doing the detailed analysis of the May 17 data that will provide the scientific community with fresh insights.

UNH is funded for the PAMELA mission through the National Science Foundation's Solar, Heliospheric, and Interplanetary Environment (SHINE) program for the very purpose of analyzing data from these sorts of solar events because, notes Ryan, "this is an untapped capability of PAMELA. The NSF saw the value in getting this data and of having UNH, which has a strong history in [solar physics](#), lead that effort."

Provided by University of New Hampshire

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