Mini-EUSO: Seeking new heights in science from the International Space Station

Francesca Capel
Alexander Belov
Marco Casolino
Pavel Klimov
for the JEM-EUSO Collaboration

Video Abstract

Keywords: KTH Royal Institute of Technology, The Oskar Klein Centre for Cosmoparticle Physics, M.V. Lomonosov Moscow State University, Istituto Nazionale di Fisica Nucleare, Mini-EUSO, UV telescope, International Space Station, Zvezda, transient luminous event, meteor, strange quark matter, bioluminescence, space debris, debris remediation, extreme energy cosmic ray, atmospheric science, photo detector module, weather, lightning, nadir

DOI: https://doi.org/10.21203/rs.3.rs-83630/v1

Abstract

Dark matter, cosmic rays, otherworldly lightning, and meteors. Not bad for a day's work. That's the ambitious workload researchers have charged to Mini-EUSO, a revolutionary new telescope peering back at earth from aboard the International Space Station. Hitching a ride on a Russian Soyuz rocket, Mini-EUSO docked with the ISS just this past August. Fitted with state-of-the-art optics, its goal is to carry out the first-ever nighttime observations of the earth's atmosphere at near-ultraviolet wavelengths. This special "UV eye" will turn the atmosphere into a gigantic laboratory for exploring fascinating scientific phenomena—some bound to teach us more about the earth, some that could teach us more about the entire universe. One of Mini-EUSO's tasks will be to search for traces of a substance known as "strange quark matter". This matter is generally believed to make up the super-dense core of neutron stars. But it might also be scattered as droplets both big and small across the universe. These so-called "strangelets" are one candidate for dark matter, and if found in our atmosphere, they could help explain how the Big Bang unfolded. Mini-EUSO will also be on the hunt for new records in high-energy physics. From the ISS, it'll look out for cosmic rays, far-flung particles from outer space, that arrive to earth with energies millions of times higher than scientists can observe using giant atom smashers. Cosmic rays with energies just below that mark have been discovered by earth-based detectors. Detecting higher-energy rays would suggest that somewhere in the universe lies a source powerful enough to spew those rays in the cosmos all the way into our atmosphere. Shifting to work that hits closer to home but is no less bizarre, Mini-EUSO will look at rare forms of lightning known as as "sprites" and "elves". While researchers have caught glimpses of these haunting displays high in our atmosphere, Mini-EUSO will help them view these spectacles like never before—in UV. The same will go for meteors and other space debris that enters our atmosphere. Finally, Mini-EUSO will track the shimmer of bioluminescent plankton in the ocean to help researchers better understand sea life and monitor pollution. Much like the lofty sights set for Mini-EUSO, the team behind the telescope is a diverse group. Members hail from France, Sweden, Russia, and Italy and are led by Japan's RIKEN national laboratory. Together, they hope that Mini-EUSO will spark further understanding of our planet and its place in the cosmos.