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Results from the first experiments of the JEM-EUSO program

The origin and nature of Ultra-High Energy Cosmic Rays (UHECRs) remain unsolved in contemporary astroparticle physics. To give an answer to these questions is rather challenging because of the extremely low flux of a few per km² per century at extreme energies such as $E > 5 \times 10^{19}$ eV.

The objective of the JEM-EUSO program, Extreme Universe Space Observatory, is the realization of a space mission devoted to scientific research of cosmic rays of highest energies. Its super-wide-field telescope will look down from space onto the night sky to detect UV photons emitted from air showers generated by UHECRs in the atmosphere.

The JEM-EUSO program includes different experiments using fluorescence detectors to make a proof-of-principle of the UHECR observation from space and to raise the technological level of the instrumentation to be employed in a space mission.

EUSO-TA, installed at the Telescope Array site in Utah in 2013, is in operation. It has already detected 9 UHECRs in coincidence with Telescope Array fluorescence detector at Black Rock Mesa.

EUSO-Balloon flew on board a stratospheric balloon in August 2014. It measured the UV intensity on forests, lakes and the city of Timmins as well as proved the observation of UHECR-like events by shooting laser tracks.

EUSO-SPB was launched on board a super pressure balloon on April 25th and flew for 12 days. It proved the functionality of all the subsystems of the telescope on a long term; observed the UV emission on oceans and has a self-trigger system to observe UHECRs with energy $E > 3 \times 10^{18}$ eV.

TUS, the Russian mission on board the Lomonosov satellite in orbit since April 28th 2016, is now included in the JEM-EUSO program and has detected so far in the UHECR trigger-mode a few interesting signals.

Mini-EUSO is in its final phase of integration in Italy, where several performance tests are being held. Mini-EUSO will be installed inside the International Space Station (ISS) in late 2018 or early 2019.

During this contribution I will summarize the main results obtained so far by such experiments and put them in prospect of future space detectors such as K-EUSO and POEMMA.

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