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The JEM-EUSO program for UHECR studies from space

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Despite intense observational efforts and a series of important results in the last two decades, the study of ultra-high-energy cosmic rays (UHECRs) remains one of the most challenging in astronomy both because their flux is extremely low (one particle per m² per billion year at the highest known energies) and because their macroscopic energies (tens of Joules) still do not provide large enough rigidities to allow quasi-rectilinear propagation in the Galactic (and extragalactic) magnetic fields. As a consequence, no direct detection of their sources has been possible thus far and their astrophysical origin as well as their acceleration mechanism remain a mystery. To take up the challenge new UHECR observational means appear necessary. The JEM-EUSO Collaboration has undertaken to open the space road to UHECR studies. For more than a decade it has been developing a realistic program to measure the UHECRs from space with unprecedented aperture. Several intermediate missions have already been completed (on the ground: EUSO-TA; under stratospheric balloons: EUSO-Balloon and EUSO-SPB1; in space: TUS) or are active on-board the ISS (MINI-EUSO), and others are in preparation for flight (EUSO-SPB2), under review (K-EUSO), and proposed for the next decade (POEMMA). We will report on the obtained and expected results of these missions and the status of the JEM-EUSO program based on the demonstrated performance of its now mature technology.

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