

# Wide-field optics and electronics for UHECR orbital detector: from prototype to pathfinder

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Two types of orbital detectors of ultra high energy cosmic rays are being developed nowadays: telescope with reflecting optical systems (TUS/KLYPVE and OWL mission with Schmidt optics) and complex lens system (EUSO/JEM-EUSO mission). They will cover much larger areas than existing ground-based arrays and almost uniformly monitor the celestial sphere. The TUS detector is the pioneering mission developed in MSU in cooperation with several Russian and foreign institutions and launched on board of Lomonosov satellite in 2016. It is a prototype for the next SINP MSU project, KLYPVE, UHECR telescope on board of Russian segment of the ISS with large mirror-concentrator, which allows decreasing the energy threshold. Finally, JEM-EUSO is a wide field of view ( $\pm 30$  deg) detector on ISS. The optics is composed of two curved double-sided Fresnel lenses with 2.65 m external diameter, a precision diffractive middle lens and a pupil. The ultraviolet photons are focused onto the focal surface, which consists of nearly 5000 multi-anode photomultipliers. It is developed by a large international collaboration. All orbital detectors have multi-purpose character due to continuous monitoring of various atmospheric phenomena.

To design of such ambitious experiment like OWL or JEM-EUSO prototypes development and pathfinder mission is very important issue. It allows to solve a number of complex technology challenges and to assess the real possibility of obtaining scientific information (first of all, the selection of events tracks and its reconstruction, real background and exposure estimations). Electronics and algorithms for on-line event selection will be tested within the project Mini-EUSO (lens detector of UV-flashes with 25 cm diameter on ISS illuminator, planned launch at 2018?). Recently to experimentally approve possibility of wide-angle optics on orbit international collaboration JEM-EUSO proposed K-EUSO mission, which is a mirror-lens telescope system on the outside of the Russian Segment of ISS. The project manages to combine technological solutions JEM-EUSO and TUS: the lightweight mirror-concentrator of 10 m<sup>2</sup> area allows to registered UHECRs with energies above 50 EeV, and optical aberrations correction using a Fresnel-type lens lets design a photodetector with high angular resolution (in this case, photosensors and analog electronics of the JEM-EUSO can be used). In this work we provide a comparative overview of the optical systems (JEM-EUSO lens system, Schmidt optics, two option of K-EUSO optics), report first results of the lightweight segmented carbon-fiber mirror manufacturing and testing and new suggestion about electronic system for K-EUSO.

## Presentation type

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