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EUSO: Extreme Universe Space Observatory - Atmosphere phenomena

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[a]EUSO has been approved for the Phase A study by the European Space Agency ESA. The Phase A study will start in April 2001 and the EUSO Collaboration will be consequently formalized.

Abstract. The idea to use the Earth s atmosphere as a natural laboratory for the detection of EECR events, requires establishment of objective criteria to distinguish between these events and other physical phenomena, which demonstrate optical emissions in the spectral interval under interest, 330-400 nm. The atmospheric fluorescence and the Cherenkov emission, caused by EECR should be retrieved from measurements performed in the presence of a continuos background nightglow. Selected spectral interval, foreseen to be examined, contains mainly molecular emissions of O_2 Herzberg band, 2^{nd} nd positive band of N_2 and the 1^{st} negative band of N_2^+ . Their intensities depend on the season, local time, longitude, latitude, solar activity, geomagnetic activity, etc. While the duration of the nightglow is in order of hours, other type optical phenomena: tropospheric lightening and tropospheric/mesospheric interactions (Blue Jets, Red Starters, Sprites, etc.), have much shorter duration down to milliseconds, while the dynamic range of their brightness ranges several orders. We give also attention to the meteoroids, as a particular class of atmospheric phenomena. It should be mentioned that there is a very few information regarding meteoroids spectral properties in UV range. According to recent theories and models, the meteoroids are able to create marked jet-like structures in the atmosphere, exhibiting optical appearance, which could be wrongly interpreted as EECR events. Such error could arise also for the other aforementioned short-lived optical phenomena. Taking into account all this, it is obvious, that the sophisticate laboratory environment requires detailed analysis of the existing experimental and theoretical studies in order to develop appropriate tests to distinguish EERC and other atmospheric phenomena. The present work stress also on the need to develop appropriate radiation transfer model, which could appear useful tool for assessment of the real brightness of the detected fluorescence and Cherenkov emission. Such model will giving us the possibility to evaluate the energy of the penetrating EECR. For this purpose, it is important to have also adequate information about the atmospheric conditions during the measurements: concentration of the major atmospheric constituents absorbing in the examined spectral interval, pressure, temperature and humidity profiles, etc. The representative information about aerosol loading, ground and clouds albedo appears another issue which close related to the atmospheric environment also. In general, the Atmospheric Work Package in EUSO project will supply not only auxiliary information for better interpretation of the principal measurements, but it is expected to give contribution to the atmospheric physics also.

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