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## Development of a high efficient PMT Winston-cone system for fluorescence measurement of extensive air showers

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Fluorescence telescopes are an important technique to measure extensive air showers initiated by ultra-high energetic cosmic rays. They detect the longitudinal profile of the energy deposited in the atmosphere by the de-excitation of nitrogen molecules in the UV-range. In the past years the development of photomultiplier tubes (PMT) has led to an increase of more than 30% in photon detection sensitivity, by using new super-bialkali (SBA) photocathodes. Thus, the telescopes can detect even fainter signals over a farther area with a significant increase in aperture. To develop a telescope for a next generation cosmic ray observatory, a camera needs to have a maximal sensitive area of the focal plane. Winston-cones can efficiently cover the dead area between the photocathode of the PMTs. Such a highly efficient system composed of a SBA PMT and Winston cone has been developed based on the design of the fluorescence telescopes of the Pierre Auger Observatory. This contribution shows the development of the optical detection system and first tests in one of the fluorescence telescopes.

### Collaboration

– not specified –

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**Primary author:** KAMPERT, Karl-Heinz (Universität Wuppertal)**Co-authors:** RAUTENBERG, Julian (Bergische Universität Wuppertal); Mr QUERCHFELD, Sven (University Wuppertal)**Presenter:** KAMPERT, Karl-Heinz (Universität Wuppertal)**Session Classification:** Poster 1 CR**Track Classification:** CR-IN