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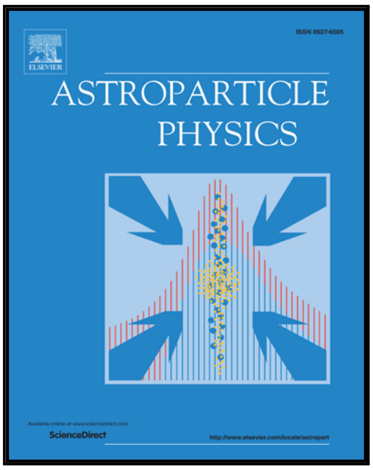

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Razmik Mirzoyan , Cornelia Arcaro , Hanna Kellermann , Markus Garczarczyik

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Razmik Mirzoyan[a], Cornelia Arcaro[b], Hanna Kellermann[c], Markus Garczarczyik[d]

a-Max-Planck-Institute for Physics, Föhringer Ring 6, D-80805 Munich, Germany, razmik.mirzoyan@mpp.mpg.de

b- Università di Padova and INFN, Via Marzolo 8, I-35131 Padova, Italy, now at Centre for Space Research, North-West University, Potchefstroom, South Africa and INAF - Osservatorio Astronomico di Padova, vicolo dell'Osservatorio 5, I-35122 Padova, Italy, cornelia.arcaro@nwu.ac.za

c- Max-Planck-Institute for Extraterrestrial Physics, Gießenbachstraße, D-85741 Garching, Germany, hkellerm@mpe.mpg.de

d-Deutsches Elektronen-Synchrotron (DESY) Zeuthen, Platanenallee 6, D-15738 Zeuthen, Germany, markus.garczarczyk@desy.de

ABSTRACT

The absolute reflectance of a reflector and its point spread function are the key parameters of a telescope for measuring light flux. Typically, one is using low-cost technologies for producing mirrors for the needs of astro-particle physics experiments. As a rule, these are operating telescopes in open air conditions at desert or mountainous locations, for cost reasons without protecting domes. The mirrors on such telescopes are exposed to sand in strong winds, precipitation and large temperature variations. Due to weathering, their reflectance is declining within few years. In this report we describe in a great detail the application of an *in-situ* method to the MAGIC imaging air Cherenkov telescopes for regularly monitoring their absolute reflectance and the point spread function. Compared to similar work that was previously performed, in this report we focus on important details of light losses due to scattering. These allowed us to further refine the method and significantly improve its precision. Also, we report on an *in-situ* comparison of two mirror types produced with different technologies.

I. Introduction

Often the reflectivity of a concave mirror used in astro-particle physics experiments is not unambiguously defined. Sometimes the dependence of the reflectivity of the mirror surface material on the wavelength is measured with some commercial spectrophotometer-based instrument or method and it is optimistically assumed that the reflected light is entirely focused into a small spot in the focal plane of the mirror. Until recently, no proper attention was paid to the diffuse scattered light component from mirrors.

A mirror used in an astro-particle physics experiment needs to be inexpensive and just "sufficiently good" for the given purpose. As a rule, the tessellated reflectors of ground-based air Cherenkov and air fluorescence telescopes are used to collect light on the imaging cameras providing a field of view of 3.5° - 10°, i.e., their off-axis performance is of prime importance. A single mirror tile of an angular resolution of 1 - 2 arcminutes can provide a satisfactory point spread function (PSF) for a composite reflector in the range of ~3 arcminutes. This is in contrast with the mirrors used in optical astronomy where light is typically collected in the center of the camera, within a very small solid angle, and about two orders of magnitude better angular resolution is required.

The reflectivity of the surface material of a given mirror is only one of the two main parameters describing its light collection efficiency. The second parameter describes the concentration of light in its focal plane.