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MAGIC observations of the February 2014 flare of 1ES 1011+496 applied to the measurement of the Extragalactic Background Light density

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1ES 1011+496 is a blazar located at a redshift z=0.212, revealed as a very-high-energy gamma-ray emitter by the MAGIC telescopes in 2007. In February 2014 the source underwent an unprecedented flaring episode, reaching a peak flux of almost 14 times the flux measured at the time of discovery, before returning to its low state. The MAGIC telescopes observed the source for a total of 17 nights between February 6 and March 7, during which the source displayed a remarkably stable spectral shape (estimated intrinsic photon index around 2) and significant flux variations in timescales of 1 day. The average spectrum during the flare could be well measured up to a few TeV, which makes this an ideal observation for probing the Extragalactic Background Light (EBL) through its effect on the gamma-ray flux. A maximum likelihood method was applied for the simultaneous estimation of the source intrinsic spectral parameters and of the optical depth due to the EBL, using the EBL model by Domínguez et al (2011) as a template to account for the EBL spectrum and evolution. The resulting measurement of the EBL density is among the most constraining ones obtained with gamma-ray telescopes on a single source, and is compatible with current EBL models, strengthening the case for no significant contribution of unresolved sources to the EBL.

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