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A New Method to Calibrate Ionospheric Pulse Dispersion for UHE Cosmic Ray and Neutrino Detection using the Lunar Čerenkov Technique

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UHE particle detection using the Lunar Čerenkov Technique aims to detect nanosecond pulses of Čerenkov emission which are produced during UHE cosmic ray and neutrino interactions in the Moon's regolith. These pulses will reach Earth-based telescopes dispersed, and therefore reduced in amplitude, due to their propagation through the Earth's ionosphere. To maximise the received signal to noise ratio and subsequent chances of pulse detection, ionospheric dispersion must therefore be corrected in real-time. This requires an accurate knowledge of the dispersion characteristic which is parameterised by the instantaneous Total Electron Content (TEC) of the ionosphere.

I will present a new method to calibrate the dispersive effect of the ionosphere on lunar Čerenkov pulses. This method exploits radial symmetries in the distribution of the Moon's polarised emission to make Faraday rotation measurements in the visibility domain of synthesis array data (i. e. instantaneously). Faraday rotation measurements are then combined with geomagnetic field models to estimate the ionospheric TEC. This method of ionospheric calibration is particularly attractive for the lunar Čerenkov technique as it may be used in real time to estimate the ionospheric TEC along a line-of-sight to the Moon.

Auteur principal: Dr MCFADDEN, Rebecca (ASTRON, the Netherlands Institute for Radio Astronomy)

Co-auteur: Prof. EKERS, Ron (Australia Telescope National Facilty)

Orateur: Dr MCFADDEN, Rebecca (ASTRON, the Netherlands Institute for Radio Astronomy)

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