HIGH PRECISION OPTICAL OBSERVATIONS OF SPACE DEBRIS IN THE GEO RING FROM VENEZUELA

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Presentamos resultados preliminares que demuestran que nuestro método para la detección y localización de escombros espaciales en el anillo geoestacionario, basado en observaciones realizadas desde el Observatorio Astronómico Nacional (OAN) de Venezuela, es de alta precisión astrométrica. Una expliación detallada, validación y primeros resultados está disponible en (Lacruz et al. 2017) enviado par su publicación. We present preliminary results to demonstrate that our method for detection and location of Space Debris (SD) in the geostationary Earth orbit (GEO) ring, based on observations at the OAN of Venezuela is of high astrometric precision. A detailed explanation of the method, its validation and first results is available in (Lacruz et al. 2017) submited.

We use the Cassegrain-Coudé focus of the 1-m Carl Zeiss telescope at OAN with the Hybrid Anastigmatic Aspherical Prime-Focus Corrector (Della Prugna et al. 2009) and a $2k \times 2k$ pixel CCD. The Field of View is $18.8' \times 18.8'$ with a plate scale of $0.55''/pix$. The SD positional errors are on the of order $\simeq 0.1''$ which corresponds to 20 m at the mean distance of the GEO ring.

The OAN has led a survey of the GEO ring since March 2015 obtaining over 20000 astrometric observations with images similar to those in Fig. 1. Streak-like marks are stars, point sources are satellites and SD at the GEO ring. The left panel in Fig. 1 shows an inclined streak that corresponds to a low Earth orbit (LEO) satellite while the circles in the right panel indicate SD candidates.

Our method corrects the astrometric distortion pattern (DP) introduced by the instrument. For its determination, overlapping frames were taken and the field distortion was constructed using linear terms following the method given by Stock (1981) and 11208 UCAC4 standard stars Zacharias et al. (2013). We obtain a mean error for right ascension and declination of $0.186''$ and $0.116''$, respectively.

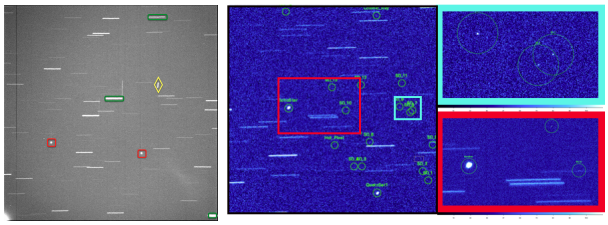

Fig. 1. Astrometric observation near the unstable region 77.0° W longitude in the GEO ring.

Fig. 2 shows the positions and error bars for two GEO satellites, EchoStar8 and QuetzSat1, obtained from 37 astrometric observations made on March 3, 2016. The positions were determined by fitting Gaussian-like PSFs to the satellite images and then correcting for the DP. The mean relative errors of the (x, y) coordinates in each panel are $(0.17'', 0.11'')$ and $(0.19'', 0.18'')$. The positions of the two objects change by $7.17''$ and $18.6''$, respectively, during 7.4 m.

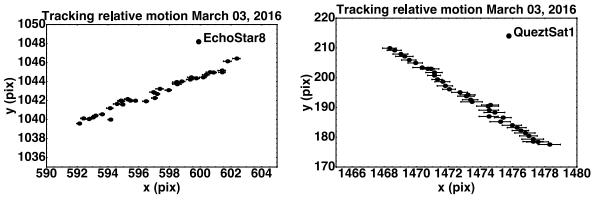

Fig. 2. Relative motion of EchoStar8 and QuetzSat1 satellites.

These preliminary results demonstrate that our method allows us to calculate highly accurate positions for satellites in the GEO ring using our astronomical instrumentation.

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