ULTRA WIDE-FIELD OPTICAL TRACKING OF LEO OBJECTS: THE ASTRA PROJECT

Alberto Buzzoni[1], Elena Barbantini[2], Albino Carbognani[1], Roberto Di Luca[1], Luca Rosignoli[1], Emanuel Rossetti[2], Fausto Cortecchia[1], Emiliano Diolaiti[1], Silvia Galleti[1], Matteo Lombini[1], Laura Schreiber[1], Giovanna Stirpe[1]

[1] Istituto Nazionale di Astrofisica (INAF), Osservatorio di Astrofisica e Scienza dello Spazio di Bologna, Via Gobetti 93/3, Bologna I-40129, Italy
[2] Dipartimento di Fisica e Astronomia, Università di Bologna, Via Gobetti 93/2, Bologna I-40129, Italy

alberto.buzzoni@inaf.it

Abstract. At the typical Low-Earth orbital regime (LEO), satellites are seen to whizz across the sky at very high angular velocity, in excess to 0.5-1 deg/sec; for this reason, a wide field of view (FOV) is mandatory for ground sensors to track at once the orbiting population of active satellites and non-cooperative debris.
However, by enhancing sky-coverage capability, one has to give up telescope sensitivity as only small optical apertures can be technically affordable for such a demanding optical design. In addition, compared to stars of same magnitude, apparent luminosity of fast-trailing objects suffers from a severe dimming effect as the photometric signal spreads along many pixels across CCD/CMOS detectors.
As an on-going effort to effectively tackle the challenging problem of optical tracking of the LEO traffic over Italy, we report here on the ASTRA (All-Sky TRacking Array) project, carried out at INAF, in the framework to the IADC support activities.
The ASTRA network consists of five twin stations, suitably located across the Italian territory. Each station is equipped with steerable ultra wide-angle f/1.4 cameras, remotely operated from the INAF SSA Control Center in Loiano (Bologna). With the ASTRA network we aim at surveying the entire orbital traffic of metric-size objects (namely spent rocket boosters and other potentially dangerous massive debris in pre-reentry trajectories) within an altitude of ~1000 km. In addition, the sensor network will also allows us to continually probe the whole GEO belt by locating any active or demised satellite bigger than 4-5 meters, down to V~12.
Fresh results from the Loiano testbed observations will be presented and discussed in the context of a revamped approach to the Kessler Syndrome.

Keywords. Wide-field optical tracking, Astrometry, Space Surveillance