

Beata Rogowska - Detection of fast moving objects using a synthetic tracking technique and astrographs equipped with sCMOS cameras

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I present a new technology in the sky surveys in order to look for fast moving and faint objects like unknown Near-Earth Objects (NEOs) or space debris. NEOs are chunks of the interplanetary matter located in orbits that allow them to enter the Earth's neighborhood. It is believed that they are relatively unchanged leftovers from a Solar System forming process. In result, they are of profound importance in understanding the structure, dynamics and evolution of the Solar System. Space debris are artificial objects left in orbit after space missions, non-operating satellites or products of in-space collisions or fragmentations of space vehicles e.g. rockets stages, paint flakes, astronauts' tools. They are potentially dangerous to operating satellites and human-in-space missions, as a single impact could produce a tremendous number of pieces and then an avalanche of collisions. Due to that detection, tracking and cataloguing of space debris are necessary to ensure safety in our cosmic neighborhood. Many of natural and artificial objects which are close to Earth are also intrinsically faint and move rapidly in the sky (even a few degrees per day for NEO, degrees per second for LEO debris), therefore their detection is complex.

I present the concept of modern observational technique for their detection. The technique is called synthetic tracking (ST) and its main goal is to mitigate the trailing loss caused by smearing an object's image through the field of view (FOV) during a long exposure. The idea is to acquire a large number of short exposure frames, then shift and add them to simulate telescope tracking of the object. The powerfulness of this method depends on modern technologies like sCMOS detectors and wide FOV telescopes called astrographs. The sCMOS cameras are a new generation of CMOS technology called scientific CMOS. They are characterized by high-speed and low noise read-out. Astrographs are capable of capturing a bigger piece of the sky during a single exposure and so allow covering a large area of the sky during one night.

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