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Identification of serendipitously observed near-Earth objects in images of the Hubble Space Telescope and ground-based observatories

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Discovery and identification of Solar System Objects (SSOs) are necessary preceding steps to their characterization. We present here the results obtained after searching the HST archive for near-Earth objects (NEOs). Cross-matching the orbits of all ∼19,000 NEOs in the ASTORB Database with the footprints of 1.3 million HST exposures using an algorithm developed by the IMCCE and the ESASky team, we identified 8,666 potential serendipitous observations of NEOs with ephemeris uncertainties equal to or below 1 degree. Visual inspection of 317 images revealed 15 observations of 10 unique NEOs, of which we extracted the astrometry and photometry. More objects may be present in the images but large ephemeris uncertainties and degrees of image contamination hinder the identification. Our application highlights the potential of this method and harvesting the HST archive for SSO detections, as well as the need of astrometric measurements to refine the orbital calculations.

Furthermore, we searched for SSOs in public image repositories using a versatile detection pipeline we developed. The pipeline is able to identify both known and unknown SSOs in astronomical images mainly based on their apparent motion, which naturally favours the detection of the fast moving NEOs. We present the results obtained and difficulties encountered using GTC/OSIRIS (DR1) and OAJ/T80Cam (DR1), including the detection of about 4,800 SSOs. Using the IMCCE SkyBoT service to cross-match the SSO detections, we identified about 4,000 of these objects, from close NEOs to distant objects of the Kuiper Belt. We will further describe the on-going work done with ESO/VISTA, ESO/VST, UKIRT/WFCAM, and Subaru/HSC images.

Identifying the vast amount of NEOs and other exciting objects hidden in these archives can greatly decrease their ephemeris uncertainties and add valuable photometric measurements for spectral classification, a fundamental tasks in their characterization.