

NEO Characterization

The Southern Hemisphere Asteroid Radar and Optical Program

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ABSTRACT

We describe further development of a cued southern hemisphere bistatic radar and optical program to detect near-Earth asteroids and objects (NEO's) from Australia. Radar antennas and optical telescopes in the northern hemisphere (eg GSSR, Arecibo-offline, Catalina, Pan-STARRS, Atlas, Linear) have carried most of the load to track and observe asteroids. A regular operational system to monitor the southern skies where a percentage of asteroids are uniquely detectable from Australia's geographic location, is not only desirable but vital.

To fill that gap we report on current research, synchronising Doppler-compensated continuous wave (CW) radio frequency bistatic radar transmissions at 2.114 GHz (14.2cm) and 7.15945 GHz (4.2cm) from the Southern Hemisphere Asteroid Radar Program SHARP with a small aperture wide field optical system of telescopes. Automated sub-metre class optical instruments of this type, dedicated to NEO tracking, offers rapid cueing and effective astrometry at a cost-effective level.

The SHARP Program uses available antenna time on either a 70m or 34m beam waveguide antenna located at the Canberra Deep Space Communication Complex (CDSCC) to transmit a doppler compensated CW transmissions at 20kW toward the NEO and receive its echoes at the 6x22m Australia Telescope Compact Array ATCA

antennas at Narrabri Australia. Augmenting the SHARP southern hemisphere bistatic radar capability with sub-metre class optical instruments has been shown to add an improved cueing and tracking value to the more than 30 objects so far detected by SHARP since 2015.

In 2022 we added the Falcon 0.5m f8.1 Officina Stellare Ritchey–Chrétien and Viper 0.36m Rowe-Ackermann Schmidt Celestron f2.2 optical telescopes to the NEO system to augment SHARP. This system has observed potentially hazardous asteroids 2001CB21, 2008AG33, 2012UX68, 1989 JA, 2022LV, 2022RM4, 2005LW3 and 2015RN35 of diameter 0.04-1.2km at ranges of 0.1 to 15 Lunar distances.

We found that a southern hemisphere asteroid radar program cued with an operationally flexible small optical system offers refined data for NEO astrometry, size, shape, and rotation that contributes to filling the gap in the southern hemisphere and adding to a refinement of PHA risk measures.

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