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GROUND-BASED RADAR OBSERVATIONS OF HUMAN SPACE FLIGHT ACCESSIBLE TARGETS

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ABSTRACT

We present and discuss the radar-derived dynamical and physical properties of the 114 Near-Earth object Human space flight Accessible Targets Study (NHATS)-compliant Near-Earth Objects (NEOs) that have been observed since 1998 using the Arecibo Observatory planetary radar system. The primary purpose of NHATS is to identify and characterize any known NEO that might be accessible by future human space flight missions in terms of orbital and physical properties.

The S-band (2.38 GHz, 12.6 cm, 1 MW power output) radar system on the 305-m William E. Gordon telescope is the most powerful planetary radar system in the world. Range-Doppler radar measurements can provide the distance to the target with a precision of ~10 m, the radial velocity down to ~1 mm/s, and set constraints on the spin state. The dual-polarization measurements are suggestive of near-surface chemical and structural composition. The radar images unambiguously reveal potential satellites, which can help to derive information on the mass, density, and internal structure of the bodies.

The analysis of radar observations directly addresses the major strategic knowledge gaps concerning the planning of human space flight missions. The ultra-accurate orbit refinement and the ability for physical characterization are relevant for

understanding NEO orbit distributions, sizes, and rotation rates, and also the surface environments that may pose a risk to crew, spacecraft, and operational assets. Questions of interest that we discuss are, for example but not limited to, which NHATS-compliant asteroids are the most attractive targets for crewed missions in terms of reachability or scientific importance, or what kind of near-surface physical properties can be expected.

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