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Surveying the interior secrets of the Solar System

T. Santana-Ros⁽¹⁾⁽²⁾, M. Micheli⁽³⁾, A. Campo-Bagatin⁽¹⁾, P. Benavidez⁽¹⁾, M. Żołośki⁽⁴⁾, M. Gedek⁽⁴⁾

⁽¹⁾*Departamento de Física, Ingeniería de Sistemas y Teoría de la Señal, Universidad de Alicante, Carr. de San Vicente del Raspeig, s/n, 03690 San Vicente del Raspeig, Alicante, Spain*

⁽²⁾*Institut de Ciències del Cosmos (ICCUB), Universitat de Barcelona (IEEC-UB), Carrer de Martí i Franquès, 1, 08028, Barcelona, Spain (tsantanaros@icc.ub.edu)*

⁽³⁾*ESA NEO Coordination Centre, Largo Galileo Galilei, 1, 00044, Frascati, Italy*

⁽⁴⁾*6ROADS Ltd., Godebskiego 55a, 31999 Kraków, Poland*

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ABSTRACT

Thousands of asteroids are estimated to have Interior Earth Orbits (IEOs). However, it was not until very recently that we started discovering the first members of this group of Near Earth Objects (NEOs), also known as Atira asteroids. Our knowledge about the Atira asteroids is especially relevant in the context of Planetary Defence activities. Although we expect that the vast majority of NEOs with sizes larger than 1 km are already known, a few could still be hidden in interior orbits. Gravitational resonances due to close encounters with Venus and Mercury could eventually modify the orbit of these objects sending them to outer orbits which, in an extremely unlucky case, could bring an object with an IEO into a collision path with the Earth.

However, if not discovered in previous apparitions, such an object would only have been discovered right after the impact with our planet.

Discovering new Atiras is extremely challenging, due to their proximity to the Sun. As a result of the nature of their orbits, these objects can only be observed from the Earth when being close to their aphelion, limiting their observability to a few weeks per year. Moreover, when observable, the observation window is limited to a few minutes per day, since their proximity to the Sun requires observations during astronomical twilight, pointing the telescope at very low elevations in the Sun direction.

None of the major surveys can point at extremely low Solar elongations (<35 deg). In order to increase the number of catalogued objects with IEOs, we are starting a dedicated survey which scans the sky area close to the Sun during twilight. We are using small class telescopes able to point at very low elevations, meaning from 7 to 15 deg above the horizon. Two telescopes are located in the Southern Hemisphere (Springbok in Namibia and Les Makes in Reunión), and one more is in Europe (Telescopi Joan Oró in Catalonia). Our preliminary results show that, despite the large airmass, good astrometric measurements can be obtained at these low elevations.

In addition, we are gathering observations of selected known Atiras in order to investigate their physical characteristics. For this purpose, we are using larger telescopes such as SOAR and VLT (Chile).

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