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Identification of near-Earth asteroids in archive images. A citizen-science project of the Spanish Virtual Observatory.

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Abstract

One of the most attractive aspects to the general public is the estimation of the risk level of a potential collision with the Earth as well as the mitigation strategies that may be adopted if necessary.

Discovery alone is not enough to quantify the threat level of a NEA. Above all, it is necessary to compute reliable orbits through accurate astrometric positions covering a period of time as long as possible. Also, equally important in the design of a protection strategy is the study of NEA's composition. Indeed, different composition yields different densities and internal structure/cohesion which translates into a different energy to deflect or destroy an asteroid on a collision course with Earth.

Archival data can play a key role in the characterization of the asteroid orbits as almost every single image taken by the most important ground and space-based astronomical observatories eventually end up in open archives, freely available on the web. The Virtual Observatory (VO), by ensuring an efficient data discovery, access and analysis as well as a high degree of interoperability among astronomical services, has boosted in the last years the usage of archival data in many research lines in Astrophysics.

A citizen-science is a scientific research conducted, in whole or in part, by amateur or non-professional scientists, often by crowd-sourcing. In July 2011 the Spanish Virtual Observatory started a citizen science program of characterization of the orbit and surface composition of a large number of near-Earth and Mars-crosser asteroids using SDSS images.

Through visual inspection of sequences of images, users identify the asteroid and measure its coordinates, using Aladin. After passing a number of quality checks, the asteroid positions are sent to the IAU Minor Planet Center to improve the associated orbital parameters.

Since the public release of the system in July 2011, more than 3500 users have participated in it and over 350000 astrometric measurements corresponding to more than 3600 NEAs and Mars-crossers (17% of the total census) have been realized.

For each asteroid identified by the general public, we use its coordinates to measure its flux over the different SDSS filters. This multi-wavelength photometry allows to classify the asteroids into mineralogical classes, We have now classified over a thousand planet-crossing asteroids, corresponding to an increase of the total number of classifications available to date of about 20% and 1,000% for near-Earth and Mars-crosser asteroids respectively.

In this presentation I will describe the main characteristics of the projects.