Geophysical Research Abstracts
Vol. 17, EGU2015-3051, 2015
EGU General Assembly 2015

Identifying Potentially Hazardous Co-orbiting Material of Known NEOs Using Magnetic Signatures Produced in Destructive Collisions

Hairong Lai (1), Christopher Russell (1), Yingdong Jia (1), Hanying Wei (1), and Martin Connors (2)
(1) UCLA, IGPP, ESS, Los Angeles, United States, (2) Athabasca University, Athabasca, AB, Canada

It is estimated that over 99% of near-Earth objects (NEOs) with diameters of about tens of meters are undiscovered. However, simulations show that they result in the most damage per year. Many of these bodies, produced in non-destructive collisions with larger well-characterized NEOs, are co-orbiting with their parent objects. Thereafter, scattering will occur due to gravitational perturbations when the co-orbiters have close encounters to any planets. Such gravitational scattering may not affect the orbits of the parent body. Therefore “safe” NEOs which have negligible impact probability with the Earth may be accompanied by potentially hazardous co-orbiting material.
Those co-orbitals do reveal their existence in collisions with meteoroids, which are numerous and can be as small as tens of centimeters in diameter. Clouds of fine dust/gas particles released in such collisions become charged after generation and interact coherently with the solar wind electromagnetically. The interplanetary magnetic field is then perturbed. The resultant structures have been called interplanetary field enhancements (IFEs). They are readily identified when they pass spacecraft equipped with magnetometers. Although the co-orbitals responsible for the IFEs were disrupted in collisions, they are valid samples of the remaining co-orbiting material. Therefore, we can use IFEs to identify the spatial and mass distribution of such co-orbitals.
With statistical studies of IFE occurrence, we identified asteroid 2201 Oljato and asteroid 138175 to have such co-orbiting material. The mass of the co-orbitals can be inferred by combining the results from observations and MHD simulations. Multi-spacecraft simultaneous observations measure the dimensions of the magnetic perturbations and the forces lifting them away from the Sun, while multi-fluid simulations give the accelerations of the perturbations.
In summary, our technique not only helps us to identify which NEOs are accompanied by hazardous co-orbitals, but also gives their mass distributions. Although our technique provides only the statistical properties, it indicates where high resolution optical surveys should be obtained in order to identify and track specific hazardous bodies.