

Lose of Co-orbiting Materials in the Orbit of Asteroid 2201 Oljato Deduced from Interplanetary Field Enhancements Records. H. R. Lai¹, C. T. Russell¹, H. Y. Wei¹, and T. L. Zhang² ¹UCLA, ESS and IGPP, 603 Charles Young Drive, 3845 Slichter Hall, Los Angeles CA 90095-1567, USA, hlai@igpp.ucla.edu, ctrussel@igpp.ucla.edu, hwei@igpp.ucla.edu; ²Austrian Academy of Sciences, Space Research Institute, 1010 Vienna Dr., Ignaz Seipel-Platz 2, Schmiedlstraße 6, 8042 Graz, Austria, (OEAW) tielong.zhang@oeaw.ac.at

Introduction: Interplanetary field enhancements (IFE) were first identified in the magnetic field data of the Pioneer Venus Orbiter (PVO) [1]. They are named for the cusp-shaped enhancements in the magnetic field magnitude. Most IFEs have current sheets near the center of the enhancements and some IFEs have magnetic field depressions at the boundaries [2]. Their annual rate decreases as the heliocentric distance increases from 0.72 to 5AU. IFEs are found to be moving away from the Sun at near the solar wind speed. The correlated plasma changes during the IFEs are small. Previous studies [3] show that the occurrence of some PVO-detected IFEs are associated with the appearance of a small asteroid 2201 Oljato, which is estimated to be 1.8km in diameter with a perihelion of 0.62AU. The orbit of Oljato lies inside the orbit of Venus between 126° and 220° solar ecliptic longitude (Figure 1). This sector is referred to as the Oljato sensitive region. In 1980, 1983 and 1986, when Oljato approached and receded from the sensitive region, many IFEs were detected near the crossing points and the IFE rate increased when the orbit phase difference of Oljato and Venus decreased. Since well separated large dust particles need long time to be accelerated to solar wind speed and their structure will dissipate due to lack of collective effect, IFEs must result from interactions between the solar wind and clouds of nanoscale charged dust, released from the collisions between interplanetary bodies of 10 to 100s of meters in diameter. At 0.72AU, the ‘Oljato associated IFEs’ may result from collisions between materials co-orbiting with Oljato and materials in Venus’ orbital plane. Since now we have better understanding of IFEs and Venus Express (VEX) is in orbit, we study the IFEs detected by VEX and re-analyze the PVO data using the same criteria. This time the potential ‘Oljato associated IFEs’ are not restricted to the ones detected near the crossing points of the two orbits when Oljato entered the sensitive region but all the IFEs detected in the entire sensitive region during the whole observation time. The PVO data reconfirmed the association between IFEs and Oljato. However, with VEX data, we find that although the IFE rate outside the sensitive region is the same as before, the IFE rate in the sensitive region during the VEX epoch has dropped below the average rate (Figure 2). A possible explanation is that the Oljato lost its co-orbiting materials during the

past 30 years, which can result from being destroyed by collisions or drifting out of Oljato’s orbit.

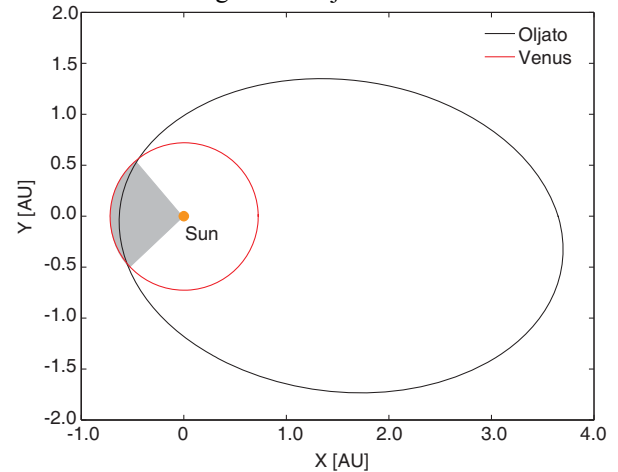


Figure 1. Orbits of Oljato and Venus in the X-Y plane in the solar ecliptic coordinate system. Oljato crosses the Venus orbit and lies within it from 126° to 220° (grey), which is referred to as the Oljato sensitive region.

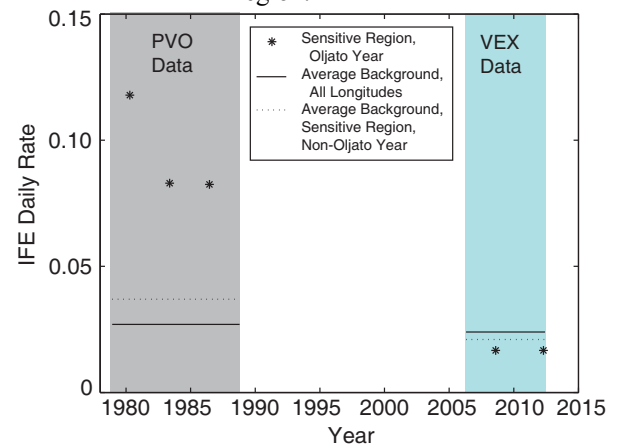


Figure 2. Temporal variation of IFE rate at 0.72AU. IFE rate detected inside the Oljato sensitive region is decreasing from 1980s to present. This indicates that Oljato has lost its co-orbiting materials which can collide with materials close to Venus’ orbit plane.

References:

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