

Non-Vestoid candidates in the inner main belt

Anomalous HEDs

HED: Howardites - Eucrites -
Diogenites

Some anomalous HEDs:

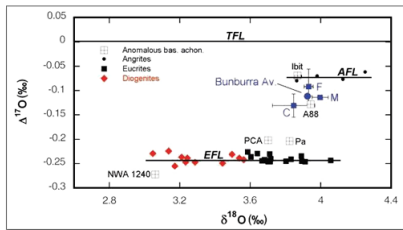


Figure: Summary of oxygen isotope data for eucrites showing the multiple possible parent bodies, as well as the anomalous Bunburra Rockhole results (from Bland et al., 2009).



(a) Ibitra



(b) Bunburra
Rockhole



(c) NWA 011



(d) Pasamonte

Bunburra Rockhole

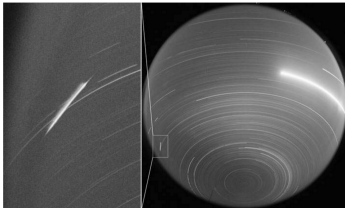


Fig. 4. All-sky image and detail containing the Bunburra Rockhole fireball as recorded by the DFO 02 station. The fireball is close to the ESE horizon and 188–127 km far from the station. This all-night long exposure took 11^h40^m. The brightest trail on the west belongs to Moon near the first quarter.

Figure: Figure adopted from Spurny et al. 2012.

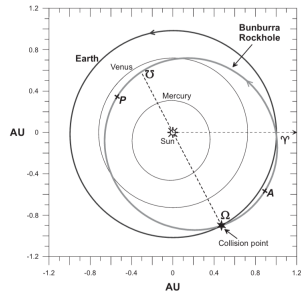


Fig. 17. Orbit of the Bunburra Rockhole (BR) (thick gray line) projected on the plane of the ecliptic, with orbits of Earth, Venus, and Mercury. P and A denote the positions of perihelion and aphelion, respectively, of the BR orbit; Ω and ϖ are the ascending and descending nodes and the dashed line connecting them is the nodal line dividing part of the orbit above (right side) and below (left side) the ecliptic plane; Υ indicates the direction to the vernal equinox.

Figure: Figure adopted from Spurny et al. 2012.



Vesta, Vestoids, Vesta fugitives and non-Vestoids

- **(4) Vesta** - the only known large intact remaining differentiated planetesimal
- **Vesta family** - population of asteroids collisionally freed from (4) Vesta
- **Vestoids** - asteroids that can be dynamically linked to Vesta
- **Vesta fugitives** - dynamically evolved asteroids that escaped the borders of the Vesta family
- **Non-Vestoids** - asteroids that can **NOT** be linked to Vesta

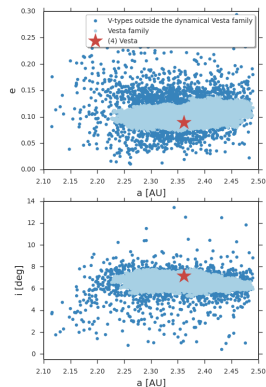


Figure: Distribution of members of the Vesta dynamical family and V-types outside the family.

Inner main belt region

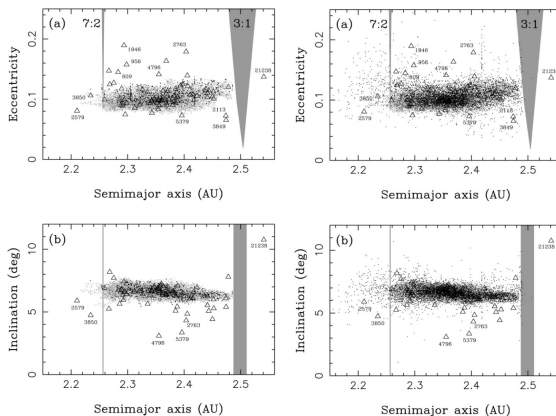


Figure: Dynamical evolution of asteroids in the Vesta family (Nesvorny et al. 2008).

Formation of differentiated planetesimals

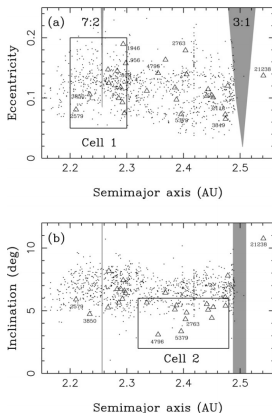


Figure: Asteroids evolved beyond the Vesta family borders (Nesvorný et al. 2008).

- 1 Vestoids that evolve to Cell 1 should have prograde rotations and thermal parameters that maximize the Yarkovsky drift
- 2 Objects in Cell 2 were not reproduced with sufficient efficiency
- 3 Determine sense of rotation and the prograde to retrograde ratios in both cells

Selecting asteroids for this survey

The epoch method

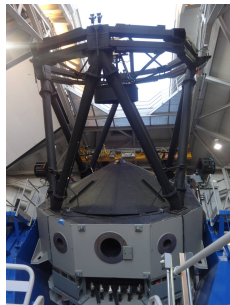
Observations



(a) 1.8m Perkins telescope



(b) 1.1m Hall



(c) 4.3m DCT

Figure: Total of 105 observing nights, majority at Lowell Observatory telescopes.

(4796) Lewis

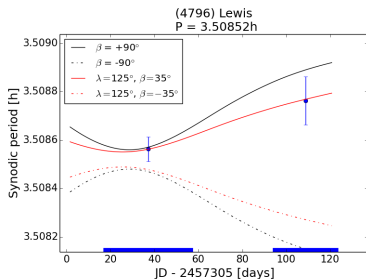
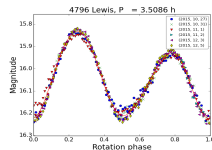
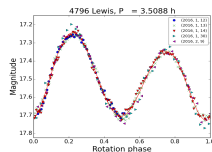


Figure: Model synodic period (Oszkiewicz et al. 2016).



(a) At opposition



(b) After opposition

Figure: Composite lightcurves



(5754) 1992FR2

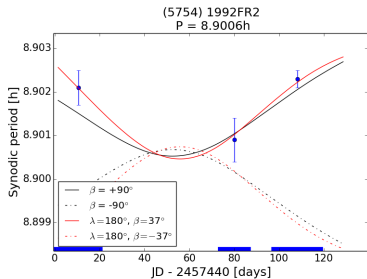
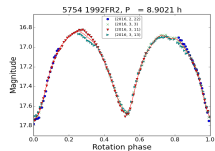
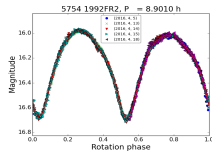


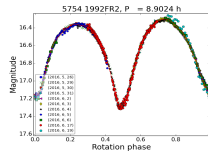
Figure: Model synodic period (Oszkiewicz et al. 2016).



(a) Before opposition



(b) At opposition



(c) After opposition

Figure: Composite lightcurves



(18641) 1998EG10

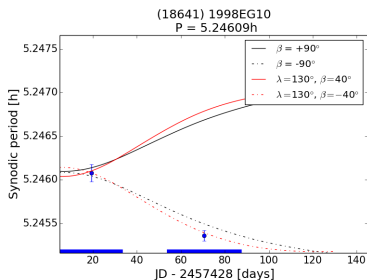
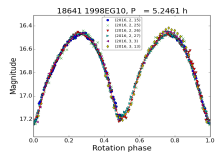
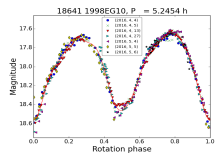


Figure: Model synodic period (Oszkiewicz et al. 2016).



(a) Before opposition



(b) Before opposition

Figure: Composite lightcurves



Conclusions:

- 1 Asteroids 1946, 8406, 5599, 5150, 18641 can be explained by migration from Vesta
- 2 Origin of asteroids 2704, 4769, 5875 is ambiguous at this point
- 3 Asteroids **809**, **5754** and **2579** are **non-Vestoid candidates**

There are **V-types** in the inner main belt that might not be linkable to (4) Vesta and thus might represent other **differentiated planetesimals**.

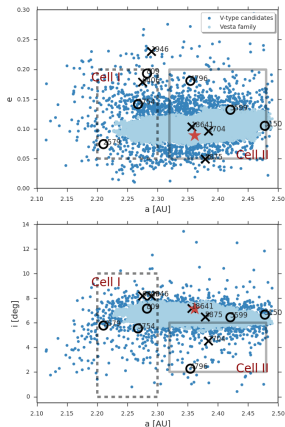


Figure: Senses of rotation of V-types in the inner main belt (Oszkiewicz et al. 2016).

Future work

Nearest future

- 1 Determine senses of rotation of V-types larger than 5 km in diameter in Cell 1 and 2
- 2 Determine the prograde to retrograde ratio in cell 2 and compare with Vesta family and dynamical simulations
- 3 Compare the distribution of non-Vestoids in the inner main belt with mid and outer main belt

Further goals:

- 1 Full spin and shape models for selected objects
- 2 Dynamical studies of selected objects
- 3 Dynamical studies of Cel 1 and Cel 2 populations



Collaborators needed!

We are looking for collaborators with access to medium size **1-2m telescopes** to join our study. Contact: dagmara.oszkiewicz@gmail.com .