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Capture of Yarkovsky-driven Asteroid Orbits into Higher-order Main-belt Resonances

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- **150 Myr** numerical integration of **1500** asteroid fragments
- symplectic integrator **swift_rmvs3**, time step = 36 days
- gravitational forces, Yarkovsky effect, simple collisional dynamics
- output: mean elements (432 yr) $\sim$ 1 GB of data per 100 particles

Initial conditions

- 7 planets (excluding Mercury and Pluto), DE 405 ephemeris
- parent asteroids: (8) Flora, (6) **Hebe**, (170) **Maria**
- five different sizes: R = 1 m, 10 m, 50 m, 100 m and 500 m
- isotropic power-law velocity distribution
- surface conductivity: K = 0.0015 W/m/K and K = 2.65 W/m/K

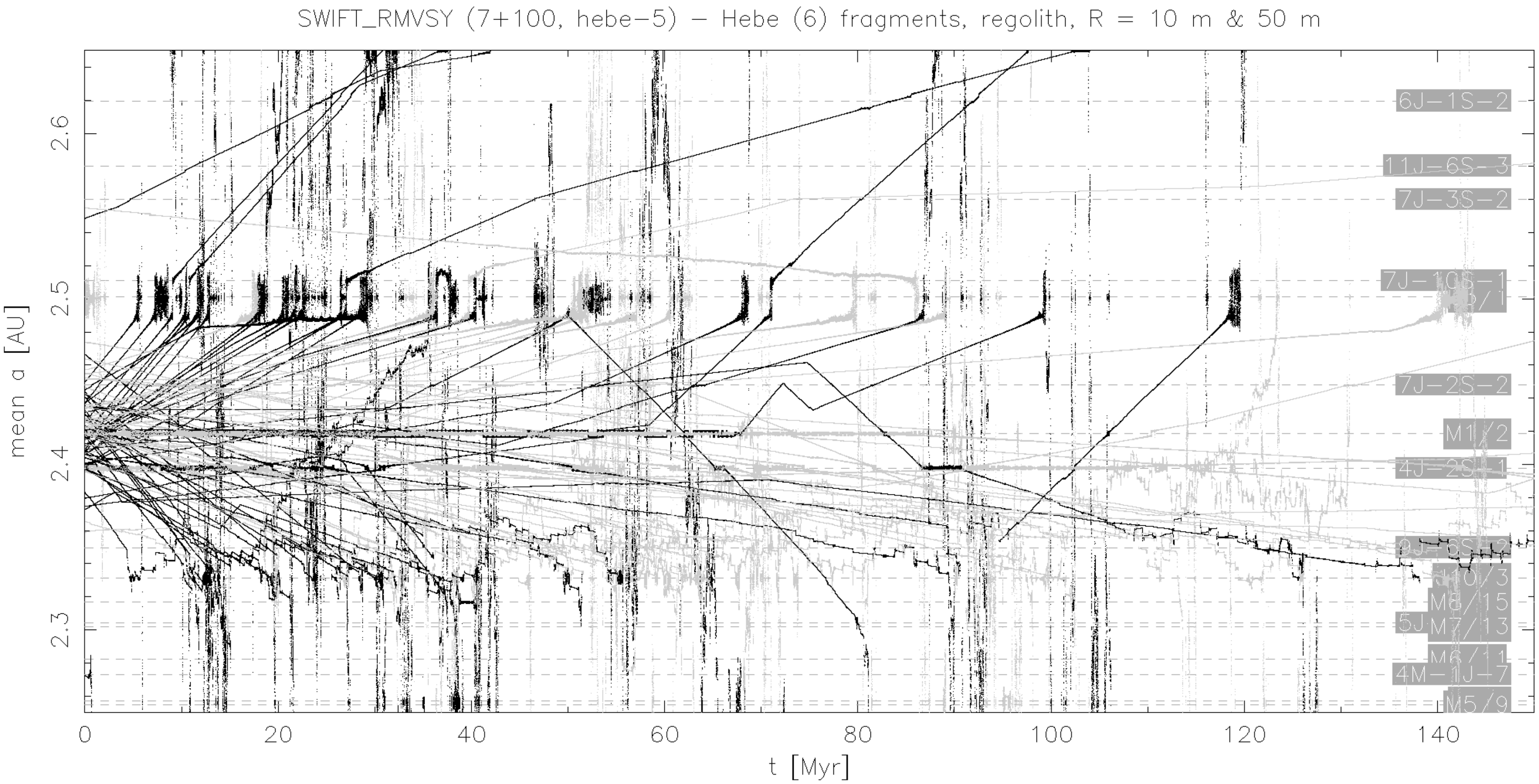
Data analysis

- Interaction with higher–order, mixed mean motion resonances
- Temporal decay of the main–belt population
- ν_6 vs. pre-ν_6 extraction from the main belt
- 3:1 crossing probability

results also on Internet: **http://sirrah.troja.mff.cuni.cz/~mira/mp/**

150 Myr integration of 7+100 bodies

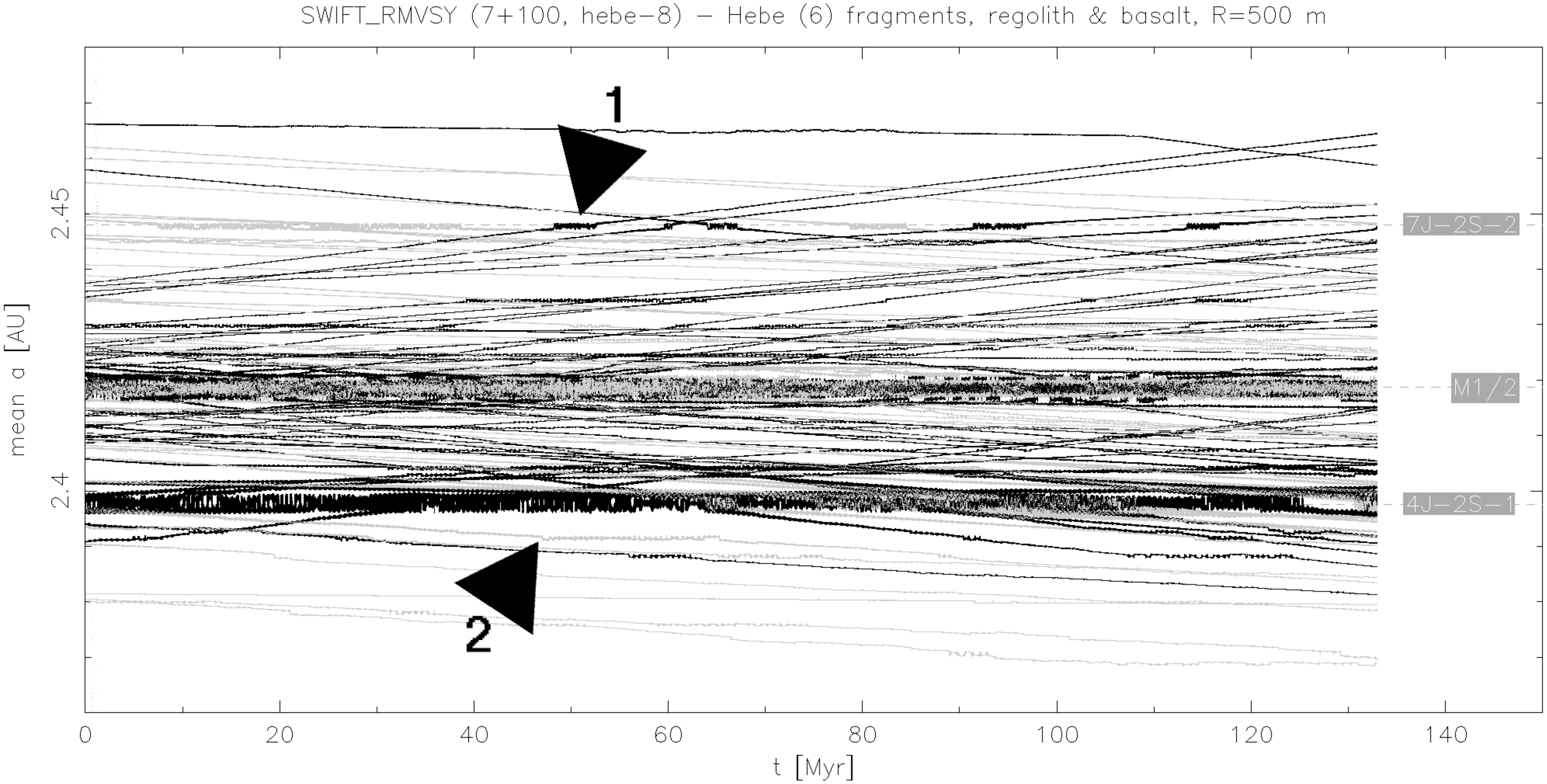
- “100” ejecta/fragments isotropically released from (6) **Hebe**
- low-conductivity surfaces assumed (“diurnal Yarkovsky effect dominates”)
- “50” fragments R = 10 m (**dark**) and “50” fragments R = 50 m (**light**)



133 Myr integration of 100 large fragments

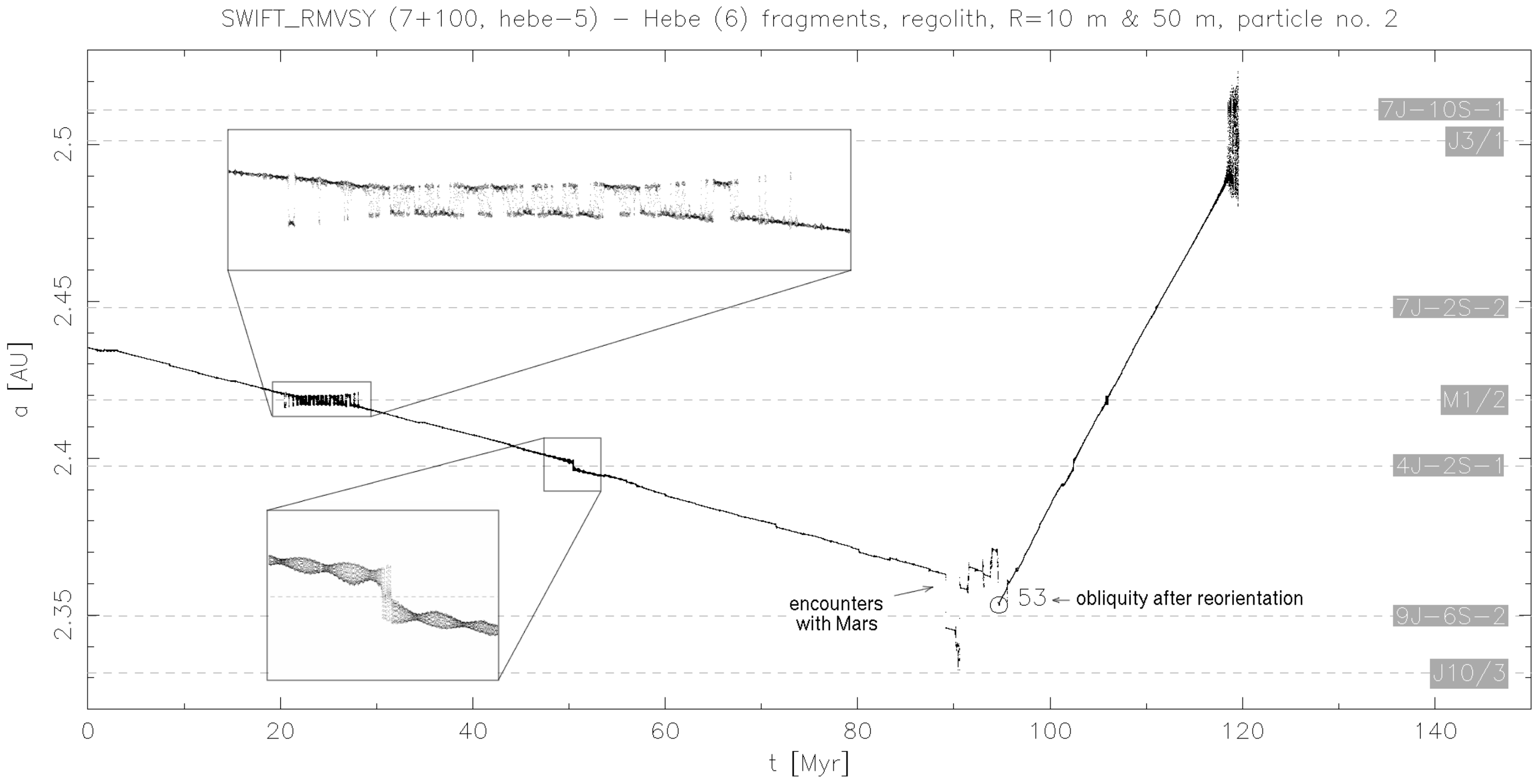
- “100” ejecta/fragments isotropically released from (6) **Hebe**
- all fragments **R = 500 m**
- “50” fragments K = 0.0015 W/m/K (**dark**) and “50” fragments K = 2.65 W/m/K (**light**)
- **slow drift rate**, particles do not reach 3:1 or ν_6 resonance within 150 Myr

(1) observable captures in 7J − 2S − 2 resonance, which do not affect drift rate
(2) captures in unidentified resonances, decrasing drift rate by $\sim$ 10 %

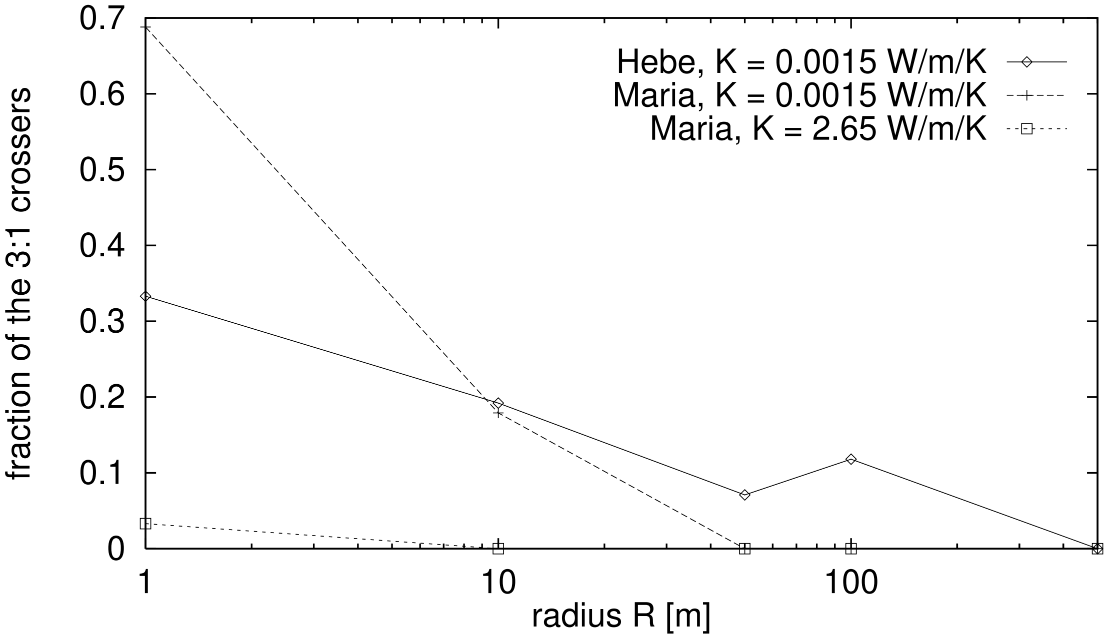


Orbital evolution of a fast drifting particle

- **Hebe** fragment, R = 10 m, regolith covered
- The capture inside the M1/2 resonance spans the same time as a drift through this region.
- The “jump” over the 4J − 2S − 1 resonance yields a higher effective drift rate.



3:1 resonance crossing probability



Temporal decay of the main–belt population