The demographics of exo-minor planets

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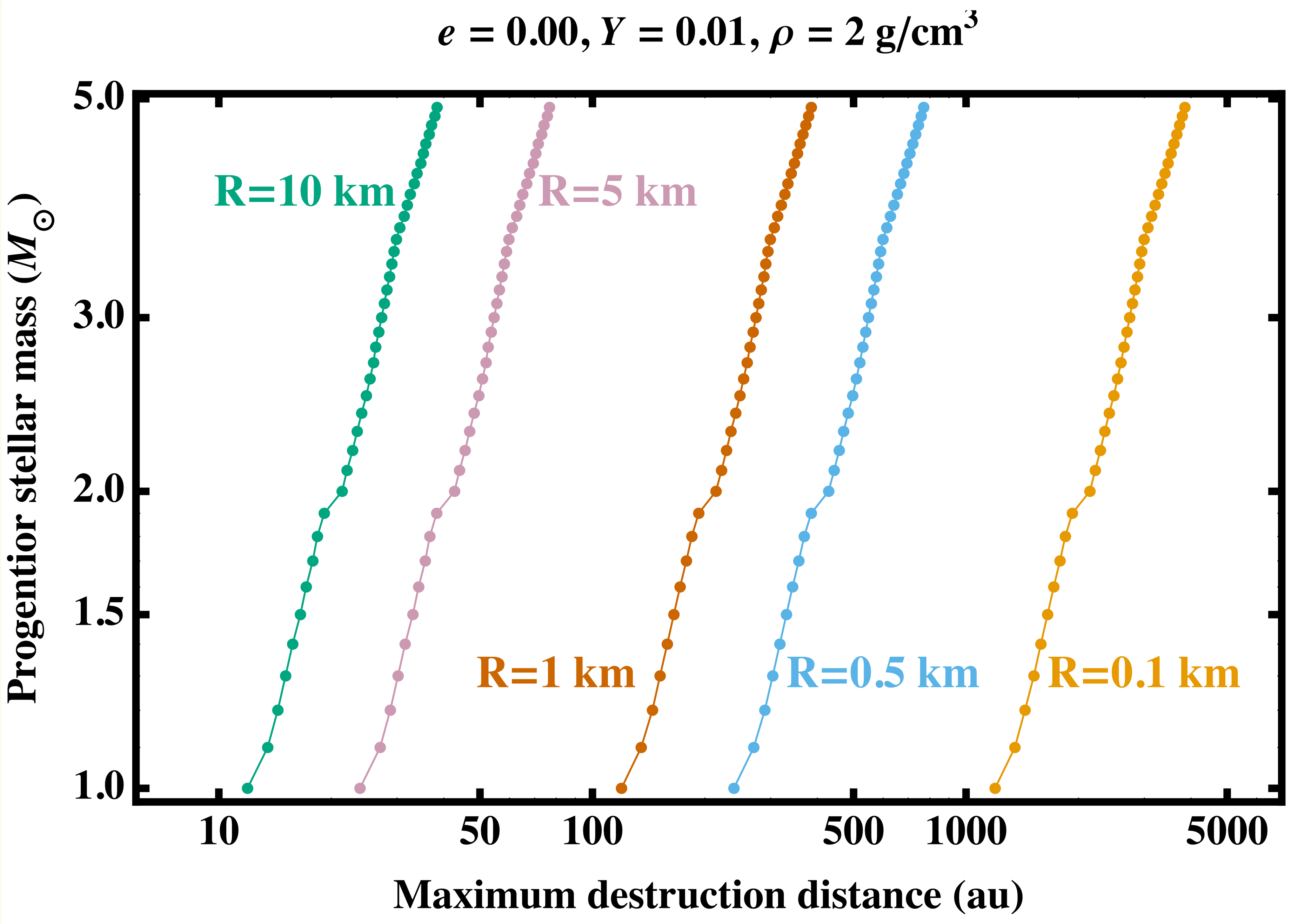
Individual exo-minor planets have been identified orbiting white dwarfs. Hence, characterizing the different populations of exo-minor planets and how they traverse the violent giant branch phases of stellar evolution through the YORP and Yarkovsky effects is crucial to understanding both their demographics and the white dwarf observations.

Post-main-sequence debris from rotation-induced YORP break-up of small bodies

Dimitri Veras,[1★] Seth A. Jacobson[2,3] and Boris T. Gänsicke[1]

MNRAS **445,** 2794–2799 (2014)

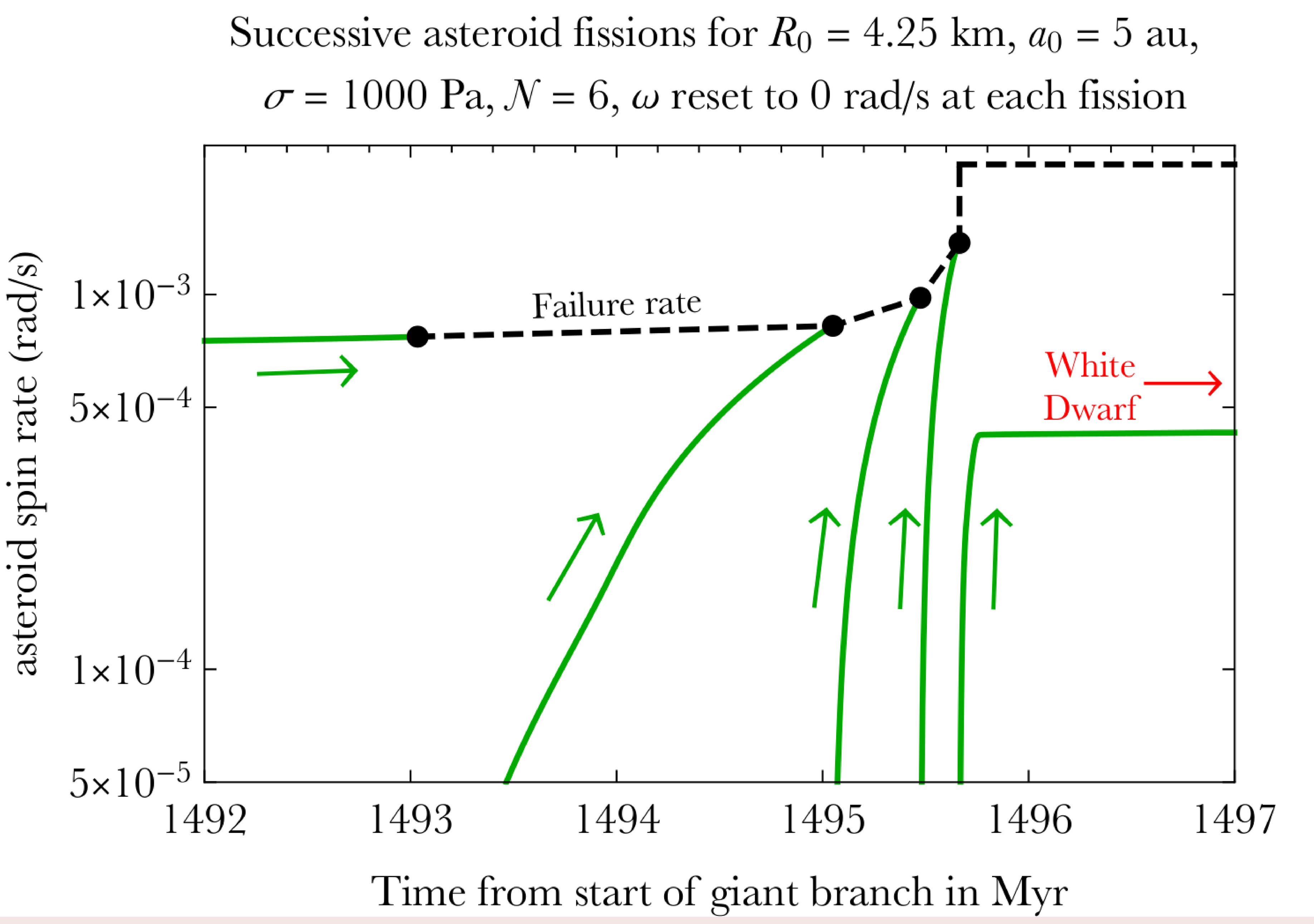


Maximum distance at which asteroids of radius R are broken up due to the YORP effect (radiative spin-up) from highly luminous giant branch radiation. These asteroids were assumed to be aspherical with an asymmetry parameter Υ=0.01 and be on circular orbits.

Post-main-sequence debris from rotation-induced YORP break-up of small bodies – II. Multiple fissions, internal strengths, and binary production

Dimitri Veras [1,2★†] and Daniel J. Scheeres[3]

MNRAS **492,** 2437–2445 (2020)

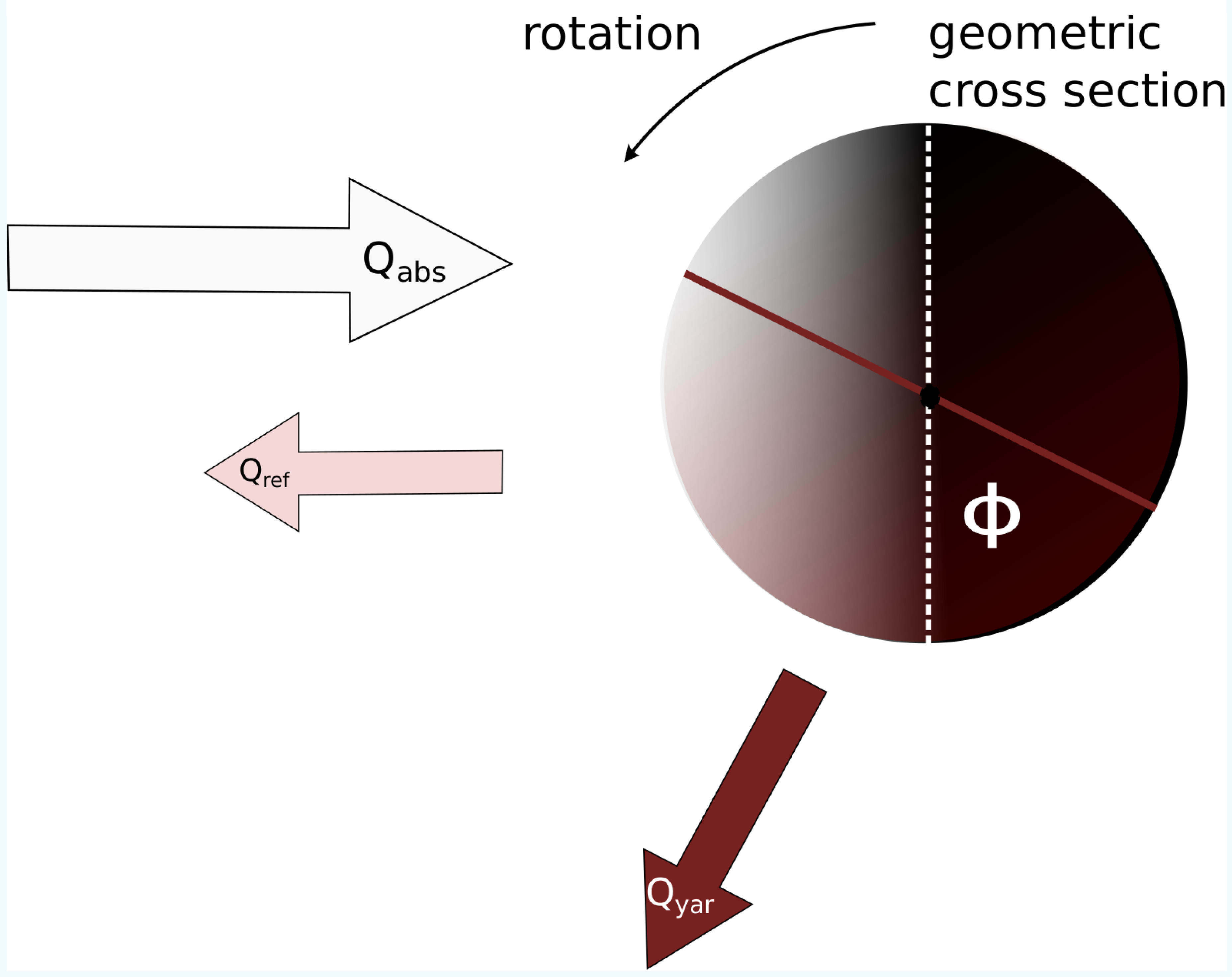


Spin evolution of an asteroid that undergoes 4 YORP fissions during giant branch evolution. In each fission, the progenitor splits into 6 equal child asteroids, generating a total of about 1300 asteroids of radii 0.39 km. Because the asteroids have internal strength (σ = 1000 Pa), the failure spin rate increases with each fission. The star becomes a white dwarf soon after the last fission.

The orbital evolution of asteroids, pebbles and planets from giant branch stellar radiation and winds

Dimitri Veras,[1★] Siegfried Eggl[2] and Boris T. Gänsicke[1]

MNRAS **451,** 2814–2834 (2015)

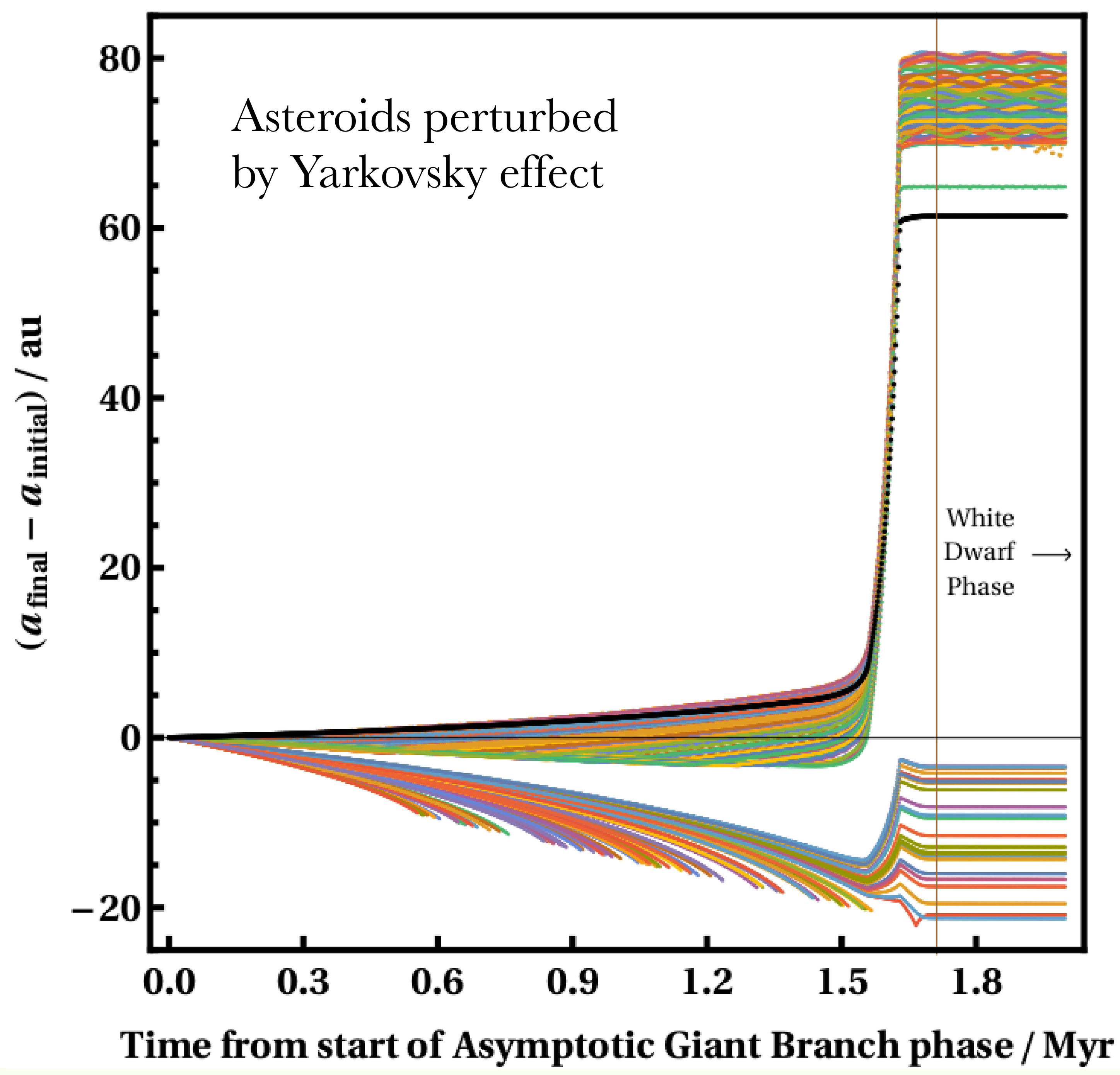


How the Yarkovsky effect changes the orbit of an asteroid through delayed anisotropic reflection. The dimension-less Q values represent the efficiency of absorbed radiation (Qabs), immediately reflected radiation (Qref), and radiation which is reflected after a delay (Qyar). ϕ is the thermal lag angle.

Speeding past planets? Asteroids radiatively propelled by giant branch Yarkovsky effects

Dimitri Veras [,1,2★†] Arika Higuchi[3] and Shigeru Ida[4]

MNRAS **485,** 708–724 (2019)



One example of how giant branch radiation can orbitally perturb asteroids both outward and inward through the Yarkovsky effect, helping to set the final orbital distribution of minor planets around white dwarfs. These simulations also include a Neptune mass planet, which moves outward due to stellar mass loss.