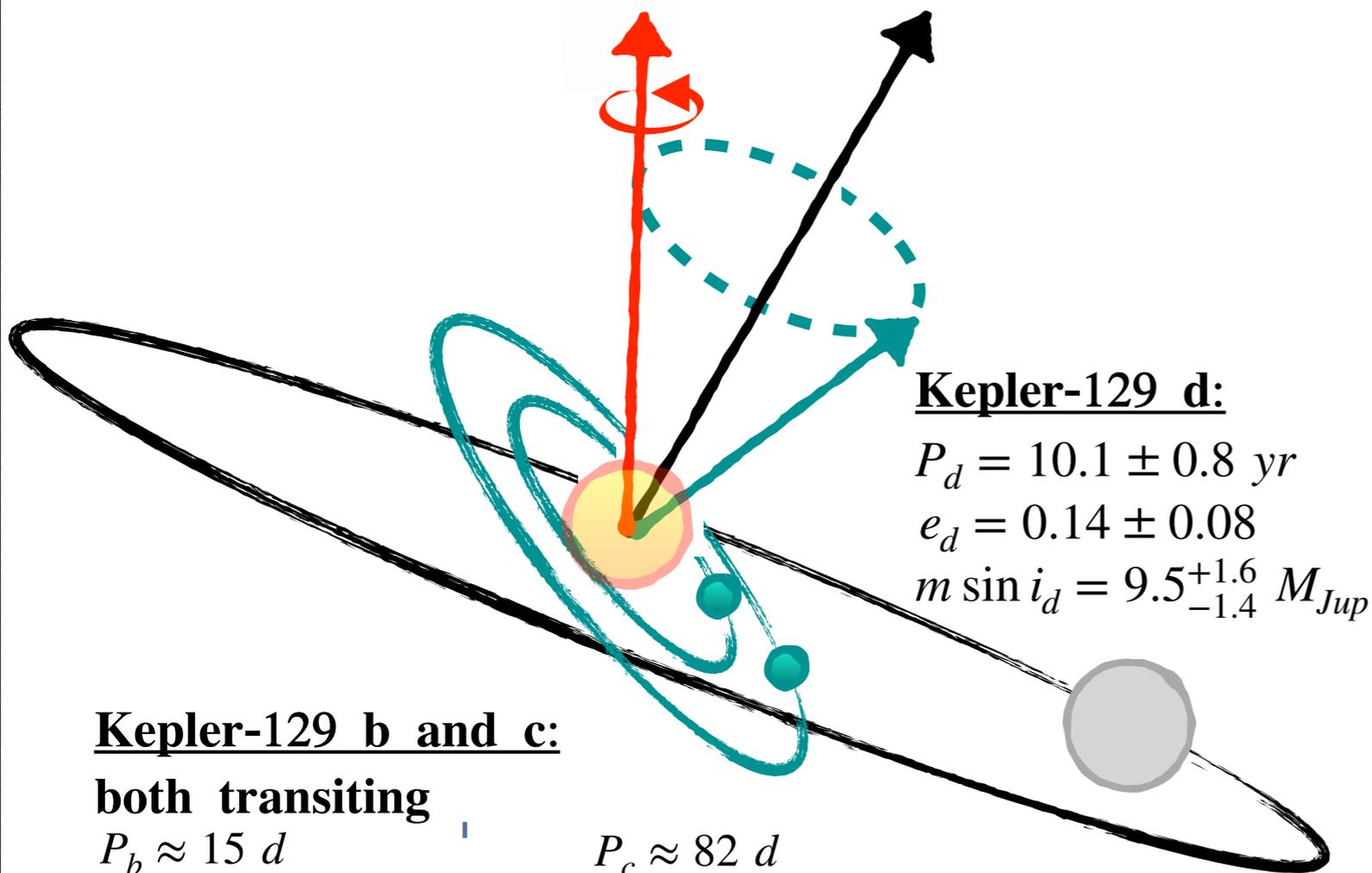


A Newly Discovered Giant Planet Causes Inner Planets to be Misaligned with the Host Star in Kepler-129

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Spin-orbit angle $> 40^\circ$



Kepler-129 b and c:

both transiting

$$P_b \approx 15 \text{ d}$$

$$P_c \approx 82 \text{ d}$$

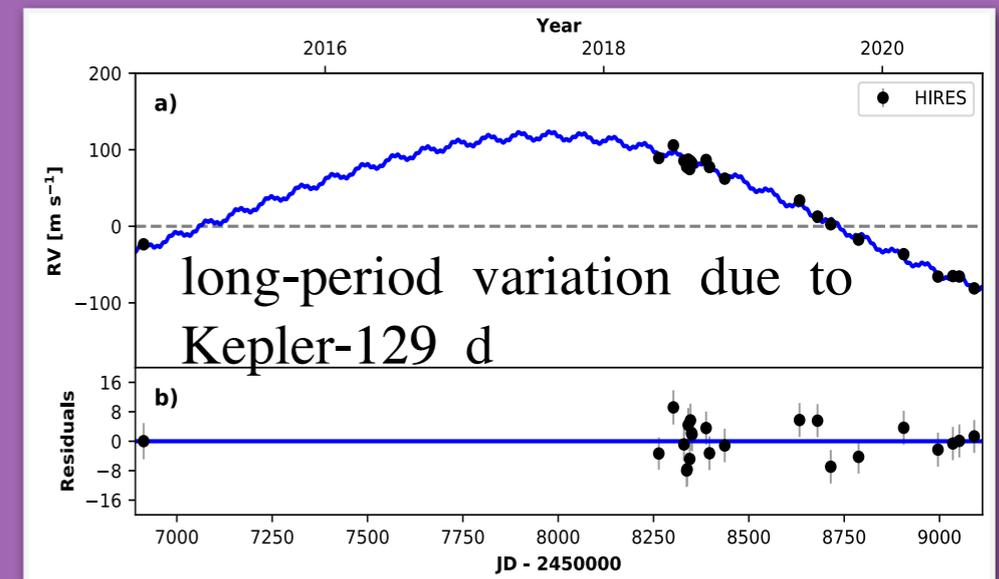
$$r_b = 2.5 R_\oplus$$

$$r_c = 2.5 R_\oplus$$

$$m \sin i_b = 7.5^{+5}_{-2.9} M_\oplus$$

$$m \sin i_c = 38^{+10}_{-11} M_\oplus$$

- Six-year radial velocity observation using Keck/HIRES :



- Asteroseismology using Kepler: Stellar spin axis is inclined by $50^\circ \pm 10^\circ$ relative to line of sight

- N-body simulation: Kepler-129 b and c transit together less than 50% time if their misaligned with Kepler-129 d larger than 30°

