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SPIN-ORBIT EVOLUTION OF GJ 667C SYSTEM: EFFECTS OF COMPOSITION AND PERTURBATIONS

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We studied the tidal evolution of the GJ 667C system, focused on the effects that different compositions and perturbations, have on the spin-down time and the probability to be trapped in a low spin-orbit resonance. For planets *b* and *c* of the system, we evaluated the probabilities of capture in resonances below 5:2 for two compositions: Earth-like (El) and Waterworld (Ww) planets.

We used the Efroimsky-Makarov-Williams treatment (Efroimsky & Williams 2009, Williams & Efroimsky 2012, Makarov & Efroimsky 2013), included in a computational tool that we call *Tidal Evolution - TIDEV* (https://github.com/facom/tidev).

We calculated the spin-down time took to reach a low resonance (3:2), and the probability to be trapped in a low spin-orbit resonance further than 5:2 for planets *b* and *c* of the system using two different compositions: El (70% mantle - 30% Iron) and Ww (50% water - 20% mantle - 30% Iron).

The capture probabilities in a 3:2 resonance varies from 47% to 0.0% for El and Ww respectively (Cuartas-Restrepo et.al, 2016). The most stable resonance is 3:2 for an El composition. The probability of capture decreases for resonances 2:1 and 3:2 to zero for a Ww composition.

We found that the bulk planetary composition have a non-negligible effect on the spin-down time. The time to reach the final resonance in some cases is almost twice compared with the value estimated for a reference El model (see Fig. 1).

Even being a close-packed system, the gravitational effect did not cause any change in the final resonance and the probability of capture is practically the same.

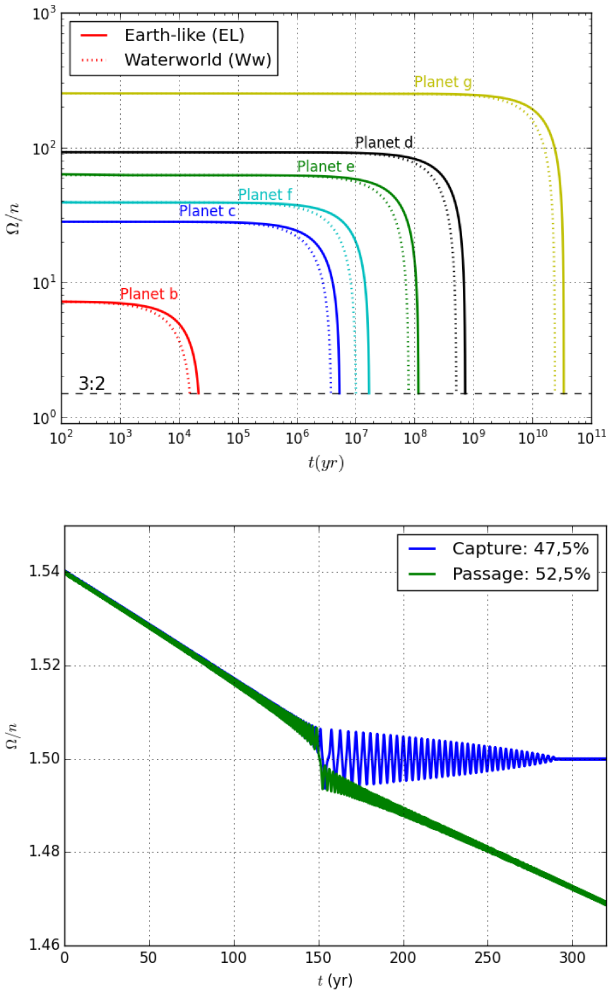

Fig. 1. Up: Spin down times. Down: Probabilities to reach 3:2 resonance for Planet b.

REFERENCES

Cuartas-Restrepo P.A. et.al., 2016, MNRAS, 463, 1592 - 1604.

Efroimsky M., Williams J. G., 2009, Celestial Mechanics and Dynamical Astronomy, 104, 257.

Makarov V. V., Efroimsky M., 2013, ApJ , 764, 27.

Williams J. G., Efroimsky M., 2012, Celestial Mechanics and Dynamical Astronomy, 114, 387.

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