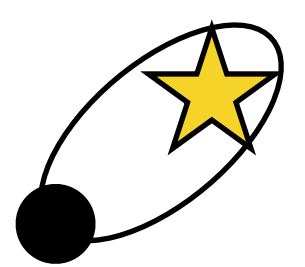
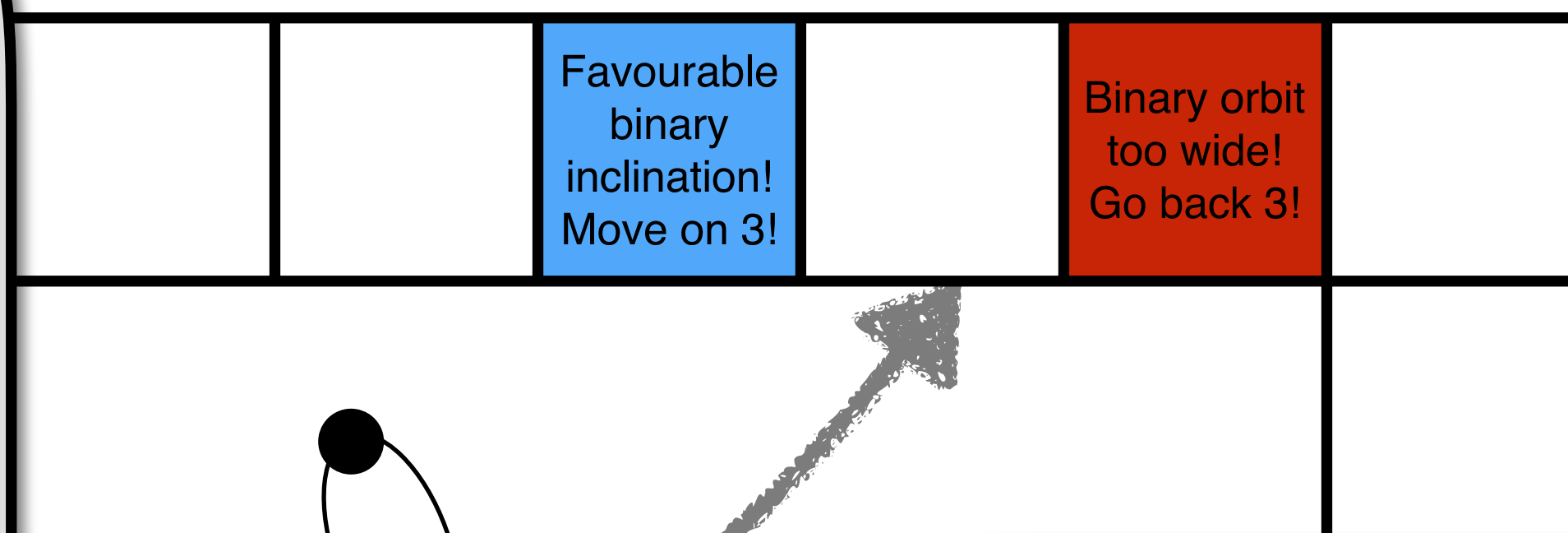


## Start

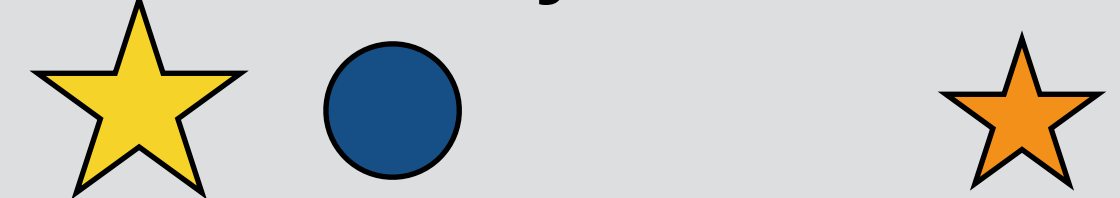
HR5183b is a planet with a high eccentricity ( $e = 0.84$ ) and a binary companion (Blunt et al., 2019, AJ, 158, 181). In this exciting game of chance, you will explore three dynamical histories explaining the eccentricity: (A) Kozai excitation by the binary, (B) planet–planet scattering, and (C) a combination of the two effects.

### Rules:

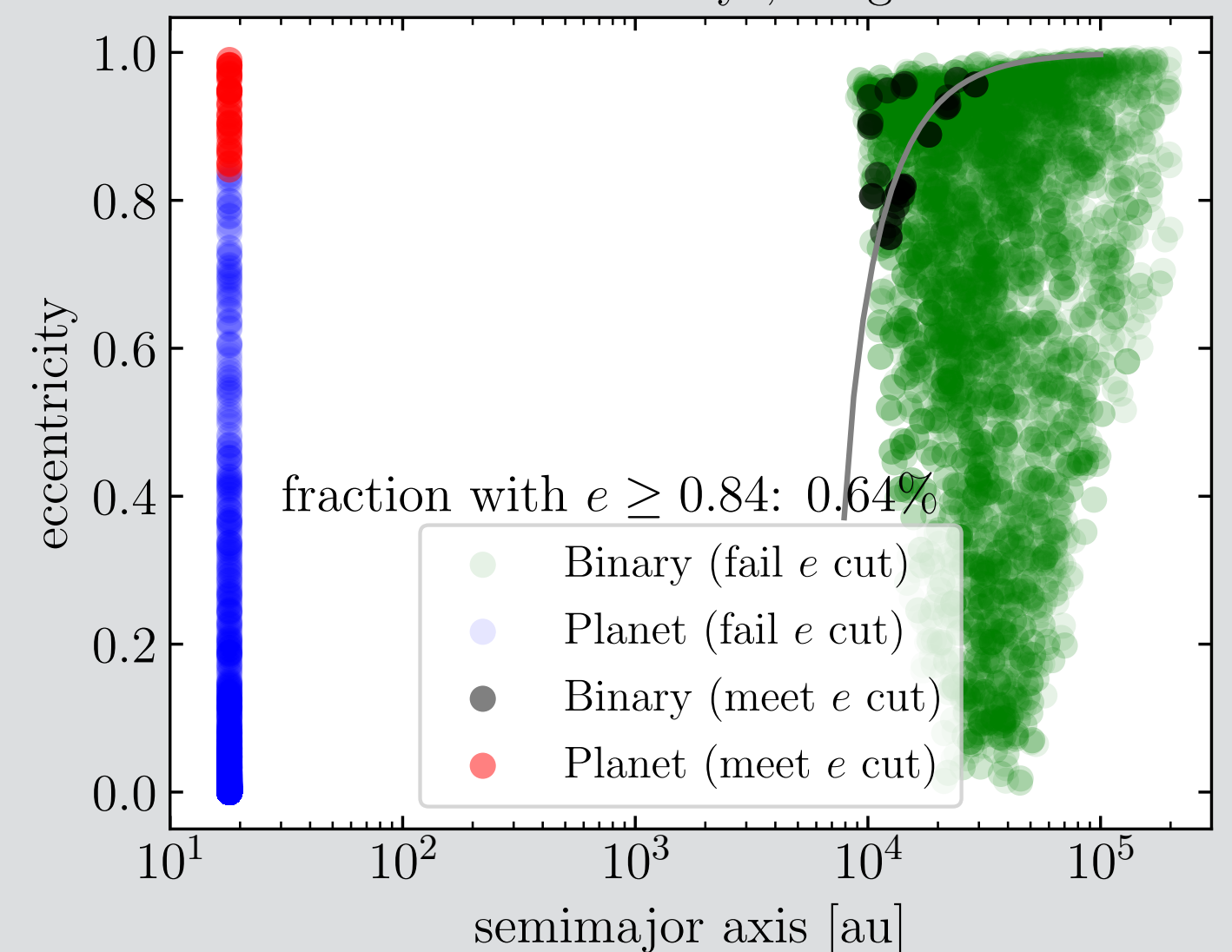
1. You need one or more 6-sided dice, and a counter per player, initially placed in the 'Start' box.
2. Decide on a turn order.
3. Each turn, throw a die and move your counter forwards that number of spaces.
4. If you land on a red or blue box, follow the instructions.
5. If you land on a rocket, move to the end of its arrow.
6. If your die roll would take you past box 'C', stay in box 'C'.
7. If you land in boxes 'A', 'B' or 'C', immediately take a die roll to see if you have won.
8. If you start in the "Inspiration" box, follow the instructions there.
9. If you start in box 'C', you simply need to roll a '6' to win!



## A: Kozai only



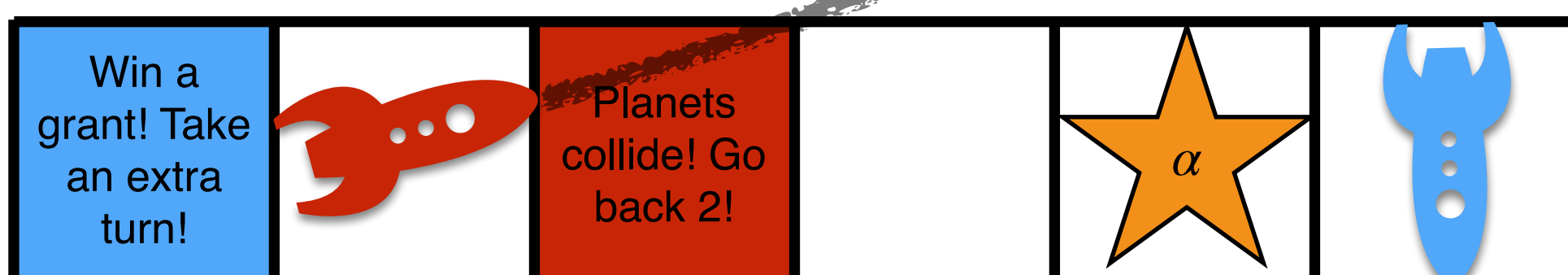
orbital elements at 8 Gyr, weighted binaries



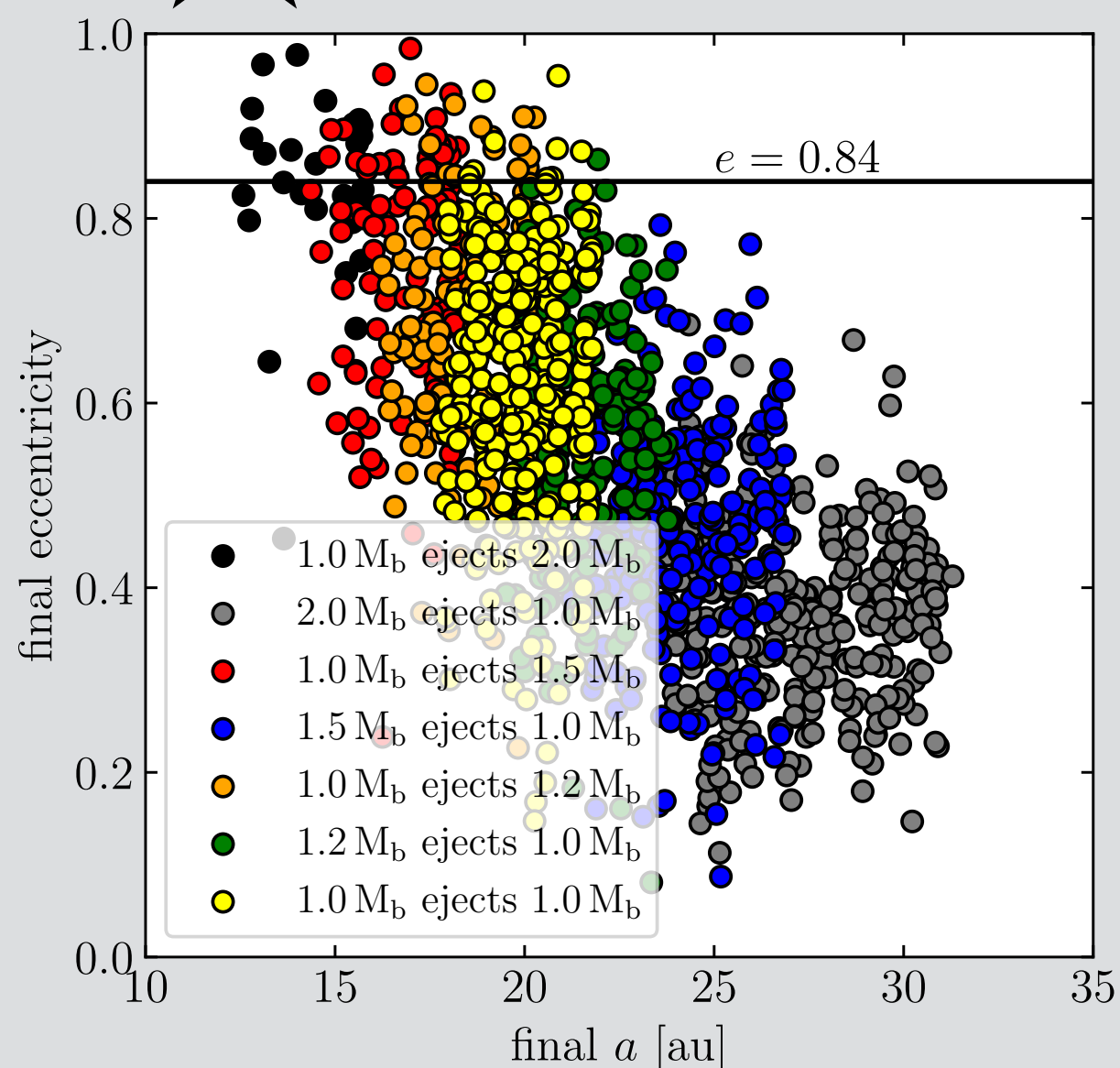
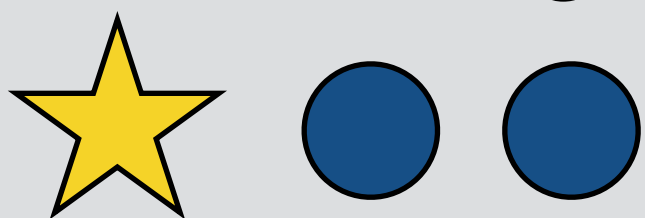
0.6% of simulations result in a planet with  $e \geq 0.84$

**To win: throw triple '6' on three dice!**

Hard disk failure!



## B: Scattering only



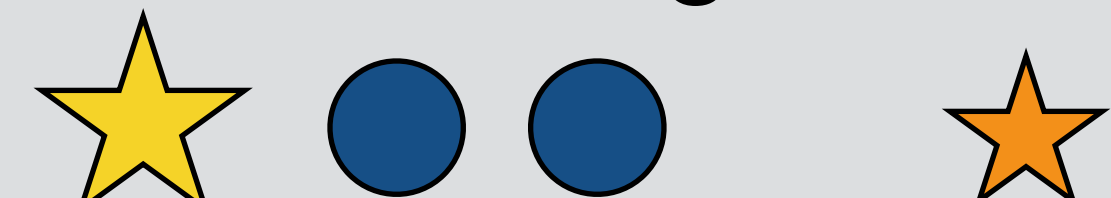
2.8% of simulations result in a planet with  $e \geq 0.84$

**To win: throw double '6' on two dice!**

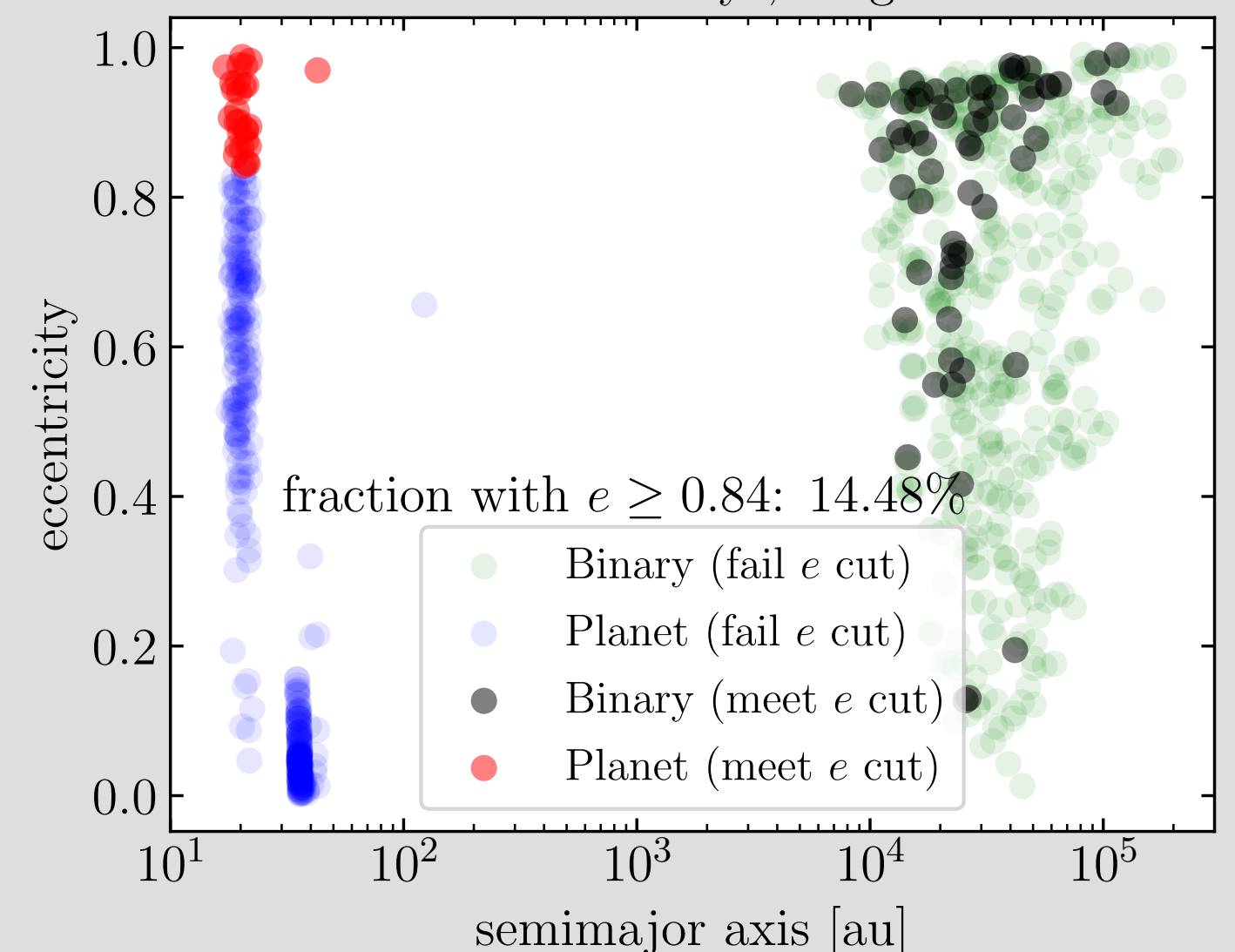
Coronavirus hits productivity!



## C: Scattering + Kozai



orbital elements at 8 Gyr; weighted binaries

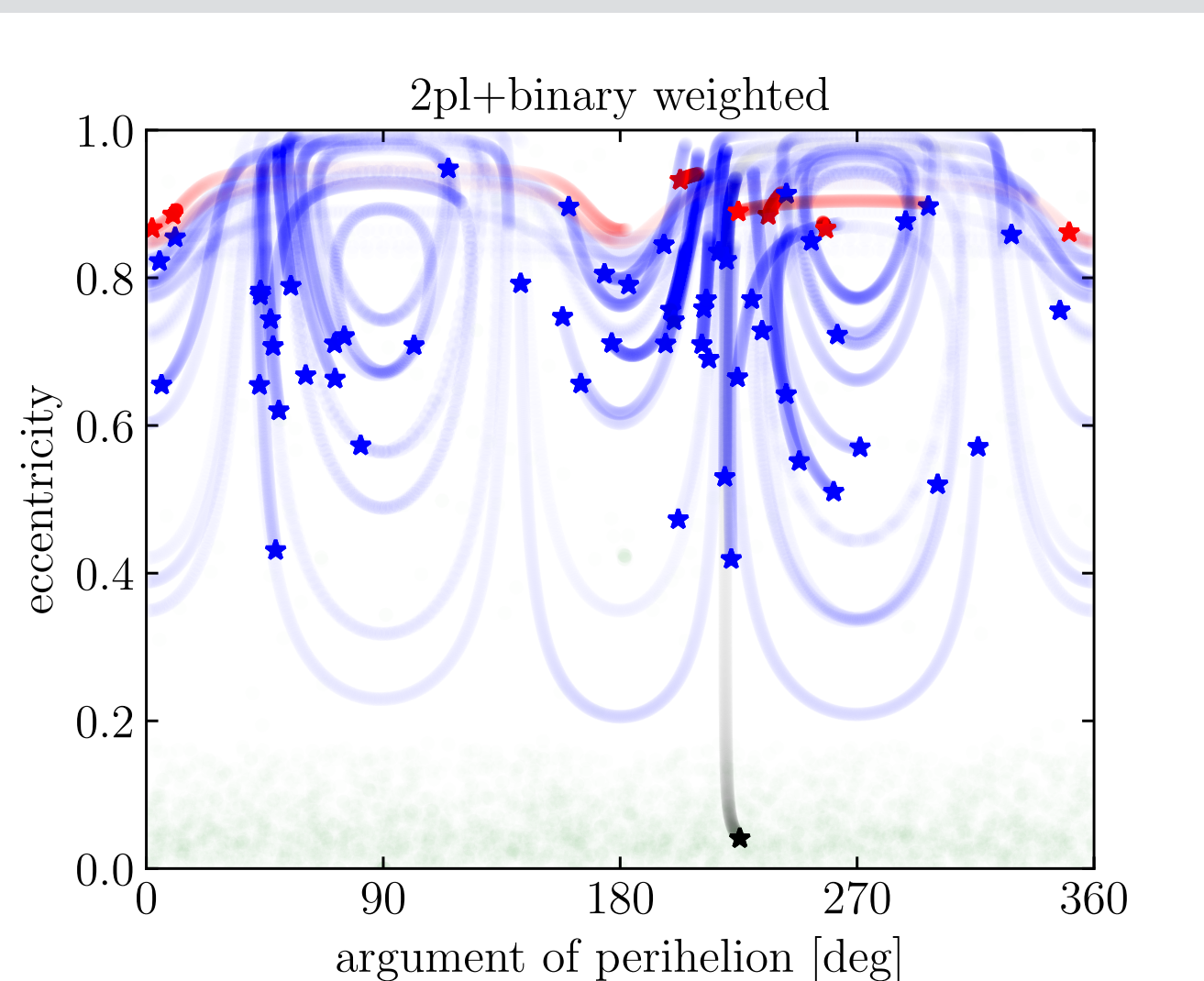


14.5% of simulations result in a planet with  $e \geq 0.84$

**To win: throw a '6' on one die!**

Inspiration strikes!

## Inspiration!



If you start your turn here, throw one die. If you throw an odd number, move to the orange star  $\alpha$ . If you throw an even number, move to the yellow star  $\beta$ . Then take your turn as normal.

What if planet–planet scattering provides an initial eccentricity boost, that can be further excited by the Kozai effect from the binary?

