Dust Clearance in a Rotating Binary (in plain English)

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What is the idea? In space, small objects (dust, asteroids) orbit bigger bodies. When there is more than one big body (e.g., a star + a massive planet), gravity can create *resonances*: repeated "kicks" that make some orbits unstable. Over time, unstable orbits get emptied, producing *gaps* in the dust distribution.

What did we simulate?

- Two massive objects orbit each other on a circular orbit (a simplified "binary").
- Thousands of massless test particles ("dust") start on random circular-ish orbits.
- We numerically integrate Newton's law of gravity and see which particles stay near the system versus get thrown out.

What did we find?

- The fraction of particles that survive depends strongly on their starting radius.
- Some radii are "danger zones" where resonant kicks make particles escape more often.
- When plotted in a frame rotating with the binary, the remaining dust shows clear structure instead of a uniform cloud.

Why does this matter?

- The same physics explains real astrophysical patterns (e.g., Kirkwood gaps in the asteroid belt).
- Even a simple model reproduces the qualitative idea: gravity can sculpt disks into rings and gaps.

Reproducible code. This repo contains the full simulation and plotting code. To reproduce the figures:

```
python src/simulate_dust.py
python src/make_figures.py
```