Lecture 3: Jump up and down and move it all around

ACM 206, April 20, 2023

Solar system collisions

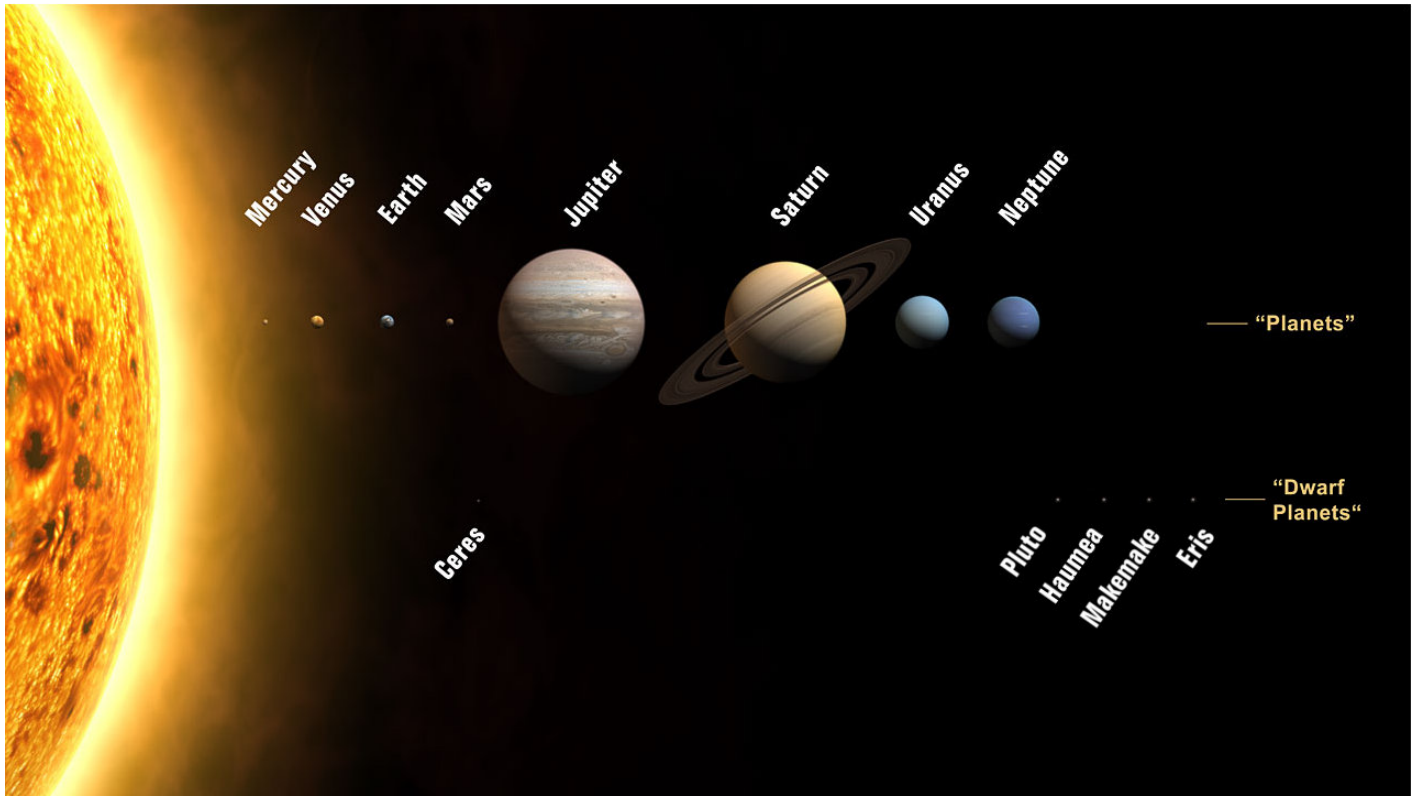


Figure: "The planets move one and the same way in orbs concentric, some inconsiderable irregularities excepted which may have arisen from the mutual actions of comets and planets on one another, and which will be apt to increase, till this system wants a reformation." (Newton, 1706)

Model details

Model details:

- Used the 4th-order WHCKL symplectic integrator and corrections due to general relativity, with an 8-day time step.
- Added 1cm random perturbations to Mercury's position every .2 Gyr.

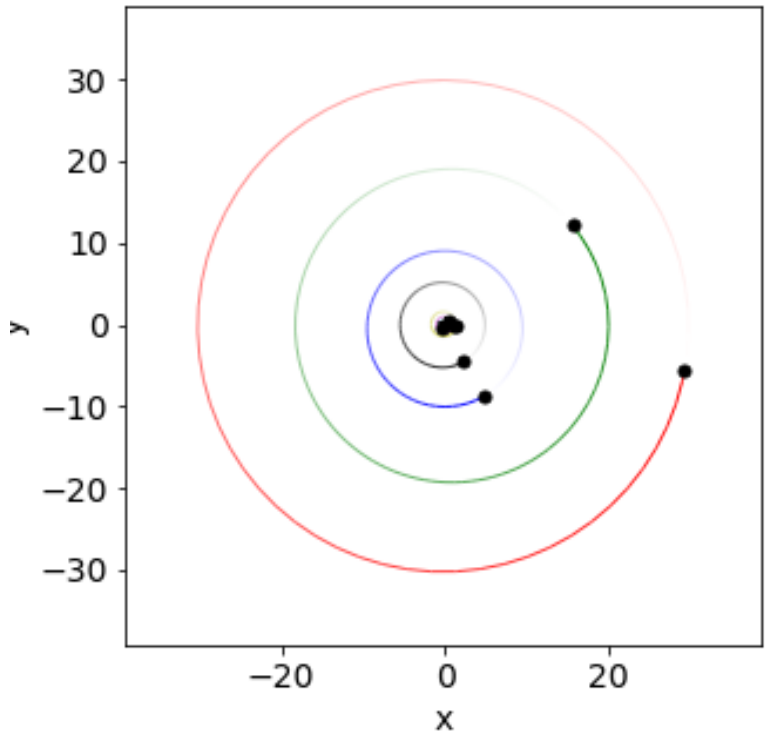


Figure: 8 planetary orbits (astronomical units)

Model

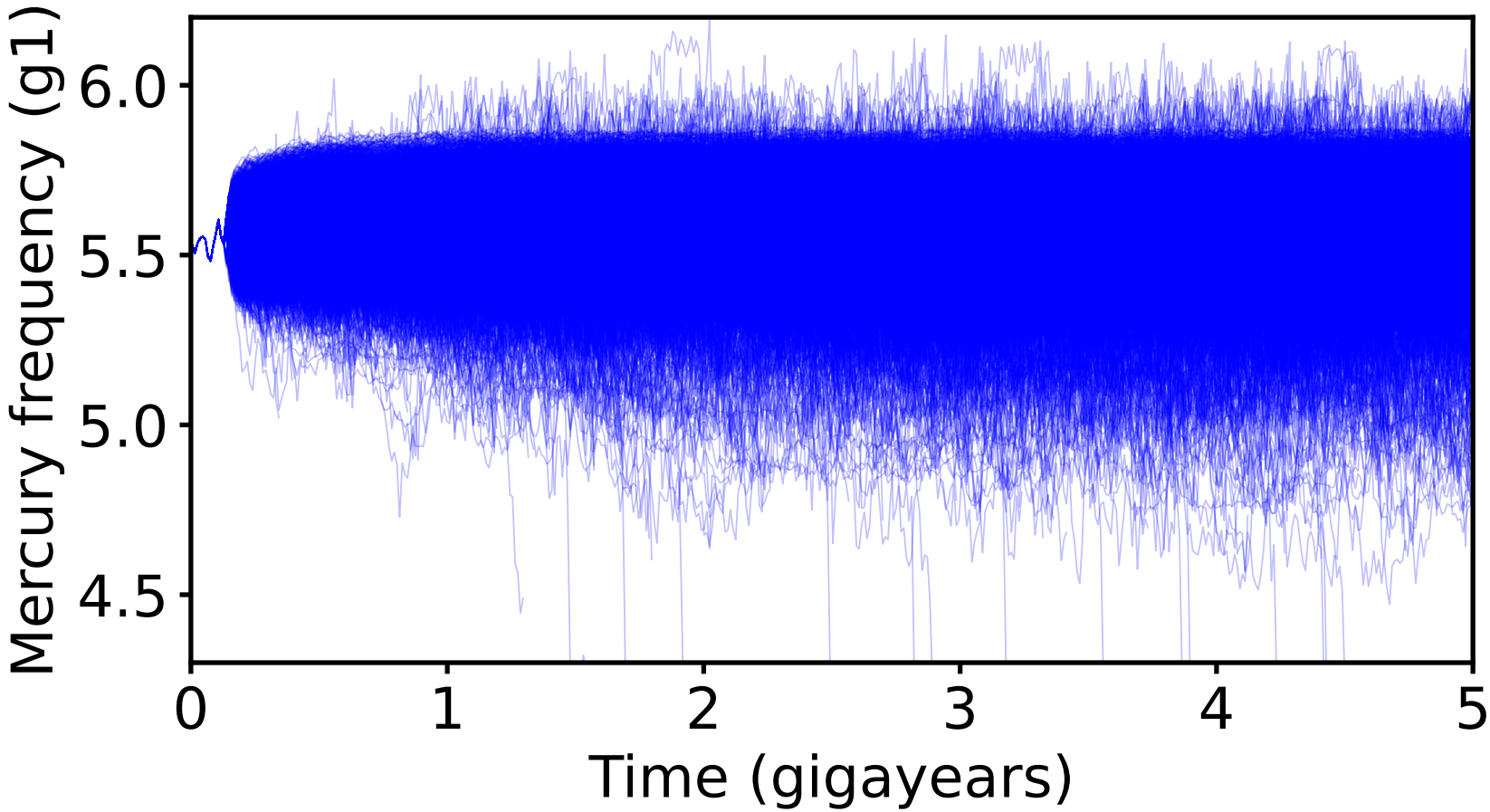


Figure: 2750 simulations: low Mercury frequencies indicate Mercury crashing into Venus or the Sun.

Model

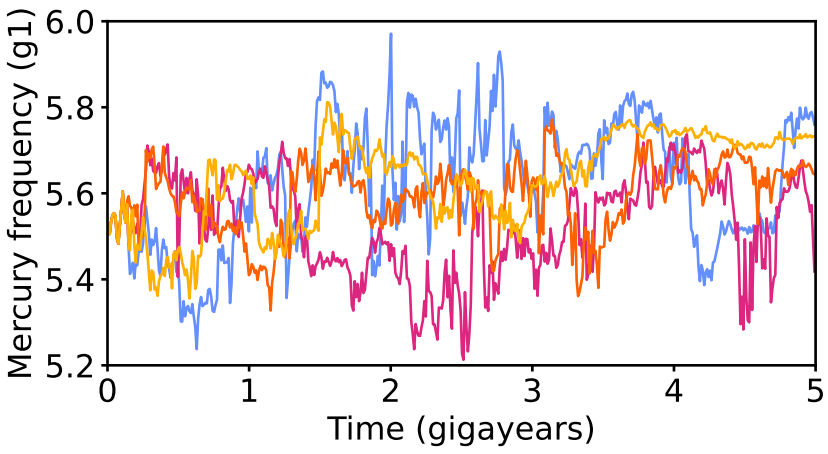


Figure: Expensive N-body simulations.

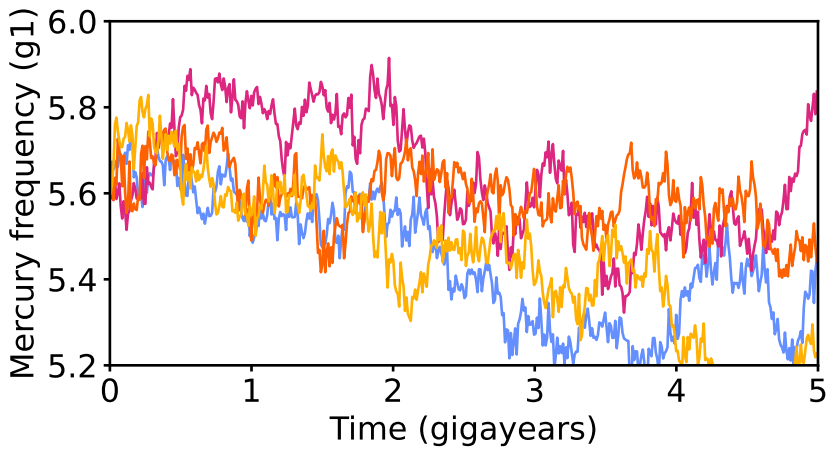
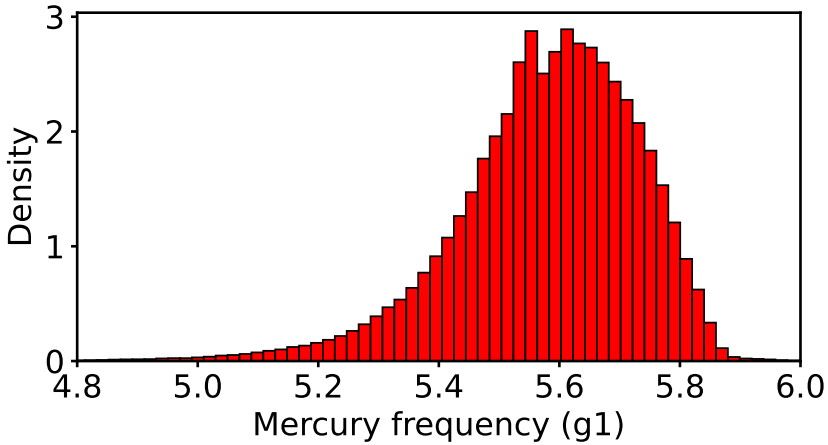


Figure: Cheap fractional Brownian motion simulations.

Model



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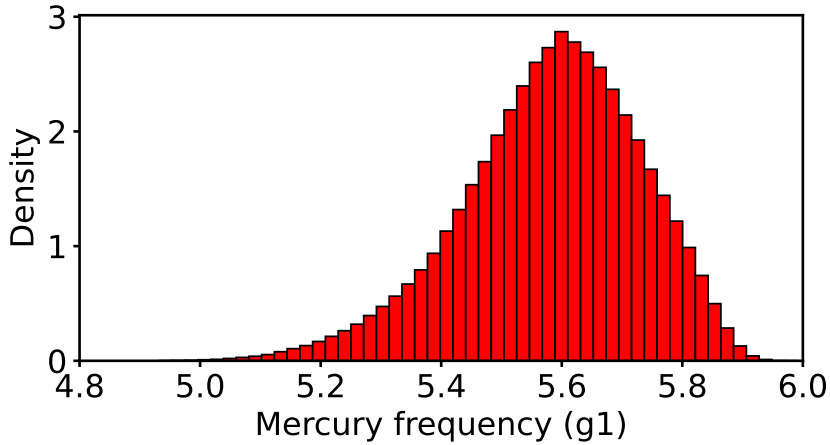

Figure: Cheap fractional Brownian motion simulations.