

Syzygy

A three-body orbit that plays three resonators.

A gravitational three-body simulation plays three modal resonators. The Sun, Earth and Moon orbit each other and the orbit is the modulation: when the bodies line up (a syzygy) they are struck, and closeness, depth in the potential well, speed and position all shape the sound.

Built from one source as two devices: **Syzygy** (instrument, MIDI in) and **Syzygy Audio** (an audio effect whose input excites the bodies). This is version 3; earlier versions are kept in [legacy/](#).

WHAT THE ORBIT DOES TO THE SOUND

collinearity (0 = in line) -> Align: syzygy strikes middle body hard, outer two soft
 pair distance (mass / d^2) -> Gravity: bodies trade energy, can self-sustain past ~55 %
 potential depth vs average -> Tide: pitch drops deeper in the well (up to 12 x Tide st)
 speed -> Bow: friction noise proportional to speed squared
 position vs listener (0,-2.4) -> pan, level, air loss, Doppler (up to 25 ms / unit)

QUICK START

- 1 Load Syzygy on a MIDI track. Press **Launch** to re-seed the orbit and a body's **Strike** (or **All**) to hear it.
- 2 Pick a **Form**. Eight is a stable figure-eight choreography. Lagrange and Euler break up after a while, and that is the point.
- 3 Raise **Align** so syzygies strike the bodies by themselves, then **Gravity** and **Tide** to couple them.
- 4 Sweep **Matter** on each body from membrane through wood, string, glass and bell to gong.
- 5 Grab a body in the orbit display and let go while moving to throw it.

CONTROLS

BODIES (SUN, EARTH, MOON)

CONTROL	RANGE	WHAT IT DOES
Pitch	-24 to +24 st	Per-body offset from Root. Defaults 0 / +7 / +12.
Mass	0.25-4	Unequal masses break any form into chaos.
Matter	0-100 %	Morphs through six mode tables: Skin, Wood, String, Glass, Bell, Gong. Defaults 80 / 60 / 30.
Level	0-100 %	Body level. Defaults 80 / 70 / 70.
Strike / All	buttons	Strike one body or all. Dragging a body in the display also strikes and throws it (release speed clamped to 2.5).

ORBIT

Rate	0.01-10 Hz	Figure-eight cycles per second. Default 0.2.
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Chaos	0-100 %	Slowly wandering random forces; weakens the energy thermostat. Default 10.
Gravity	0-100 %	Resonator coupling between bodies. Default 35.
Tide	0-100 %	Pitch bend from potential depth. Default 20.
Form	Eight / Lagrange / Euler / Swarm	Starting geometry. Launch re-seeds it (Swarm draws new positions).
Launch / Hold	-	Launch re-seeds the form. Hold freezes time.
STRIKE AND TONE		
Mallet	0-100 %	Pulse length from 6 ms down to 0.12 ms plus a click for hard hits. Default 50.
Position	0-100 %	Strike point; 0.5 cancels the even modes. Default 30.
Bow	0-100 %	Friction noise driven by body speed.
Align	0-100 %	How strongly syzygies strike.
Decay	50-30000 ms	Ring time. Default 2500.
Bright	0-100 %	Tilts partial gains and damps upper modes. Default 55.
Feed	0-100 %	Closes each body on itself through a soft clip.
KEYS, SPACE, OUTPUT		
Keys	Root / Bodies	Root: a note retunes all three bodies and strikes them. Bodies: each note claims a planet (free one, else steals the longest-held), so a triad becomes three orbiting notes.
Root	24-96	Root pitch; shares pitch with the last Root-mode note, whichever moved last wins. Default 48.
Space	0-100 %	4-line Hadamard FDN, damped and slowly modulated. Default 30.
Doppler	0-100 %	Pitch bend from radial motion. Default 30.
Width	0-100 %	Pan spread. Default 80.
Output	-70 to +6 dB	Level, with a tanh ceiling at 0.97. Default -6.
Input (Audio only)	0-100 %	Replaces Keys. A soft-clipped mono sum excites all three bodies. There is no dry path; use a rack for parallel.

NOTES

Orbit physics

Planar Newtonian gravity integrated one step per sample, bounded by a stiff wall at radius 1.6, a speed limit, contact between bodies and a thermostat that pulls energy back toward the launch value (weaker as Chaos rises). Eight is the Chenciner-Montgomery figure-eight (six syzygies per period). With equal masses, Lagrange and Euler are unstable and break up.

MIDI

MIDI goes straight to gen~ and never writes a Live parameter, so undo and automation stay clean. The action buttons are toggles the controller turns off 120 ms after a press.

STATUS

24 offline tests pass. Not yet checked in Live: the gen~ compile, CPU (24 modes plus 7 delay lines), grab-and-throw in the orbit display, and how it sounds.