Gravitas

Teaching Astronomy through Simulation

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Why we built *Gravitas*

Many introductory astronomy students struggle to visualize gravitational interactions in space.

Gravitas is a browser-based simulation, for modelling orbits, collisions, and gravity-driven systems.

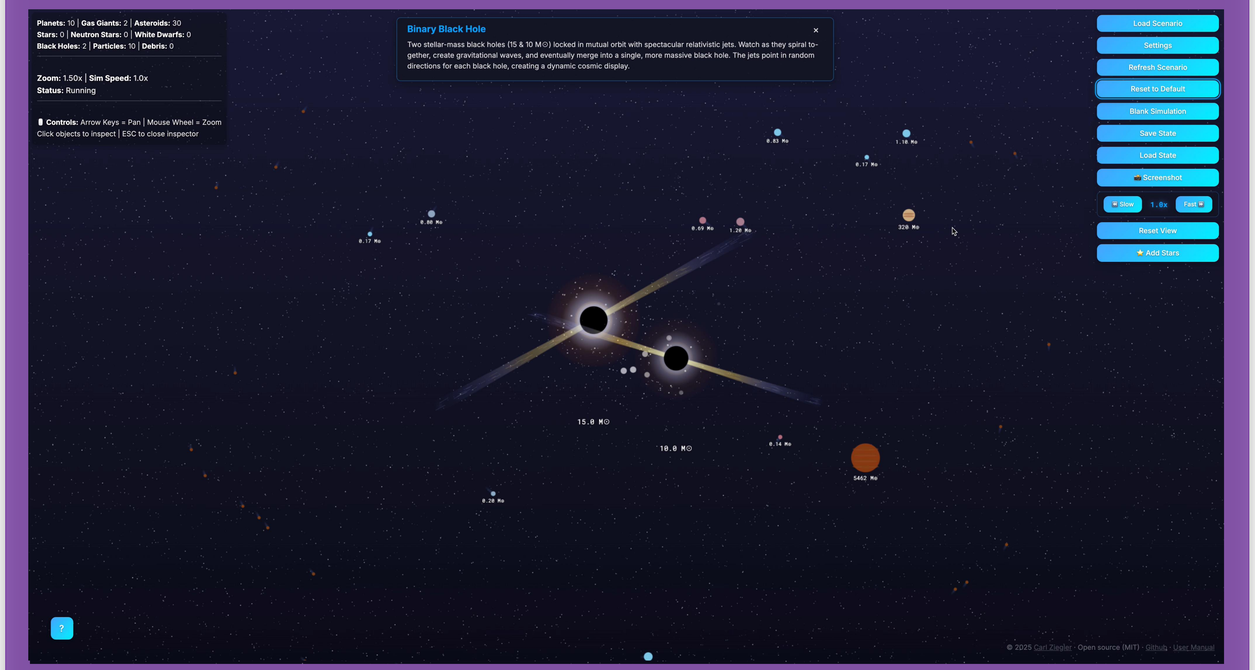
We designed Gravitas to support engagement in undergraduate astronomy labs.

What is *Gravitas?*

Interactive browser sandbox – runs on any laptop with no installs, letting users add, delete, modify, or move objects with simple mouse clicks.
Real time space-time simulator – calculates gravity with a so orbits stay stable while high-accuracy symplectic integrator horizons and mergers unfold smoothly.
Rich visual cues – shows gravitational reddening near horizons, ripple rings during black hole collisions, and a kilonova flash for neutron-star mergers.
Fully adjustable objects – sliders update mass, radius, and color scale together; preset buttons load binaries, galaxy cores, or toy solar systems in one click.
Classroom ready – paired with a four-part lab worksheet and energy-tracking panel so students can measure conservation and compare results to real LIGO data.

Gravitas is open-source:
https://github.com/gravitas-sim/gravitas-sim.github.io

Build your own universe



Gravitas is a browser sandbox that lets students **collide** black holes, **tune** stellar masses, and **watch** space-time ripple in real time.

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How it will be used in the classroom?

Guided lab sequence: four scaffolded activities (single hole capture, stable orbit mapping, binary merger timing, GW150914 recreation).
Live lecture demos: instructor loads preset scenarios to illustrate concepts like event horizons or gravitational radiation on the spot.
Inquiry homework: students save custom systems and submit energy-conservation plots for assessment.
Peer discussion: small groups compare parameter changes and predict outcomes before running the simulation.

What's next?

Piloted this fall in intro astronomy to collect in-class feedback.
Add a spin parameter so students can explore Kerr black holes.
Implement a light-bending shader to visualize gravitational lensing.
Build multiplayer collaboration so lab groups can share the same universe in real time.

Try *Gravitas*!

Go to: gravitas-sim.space

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