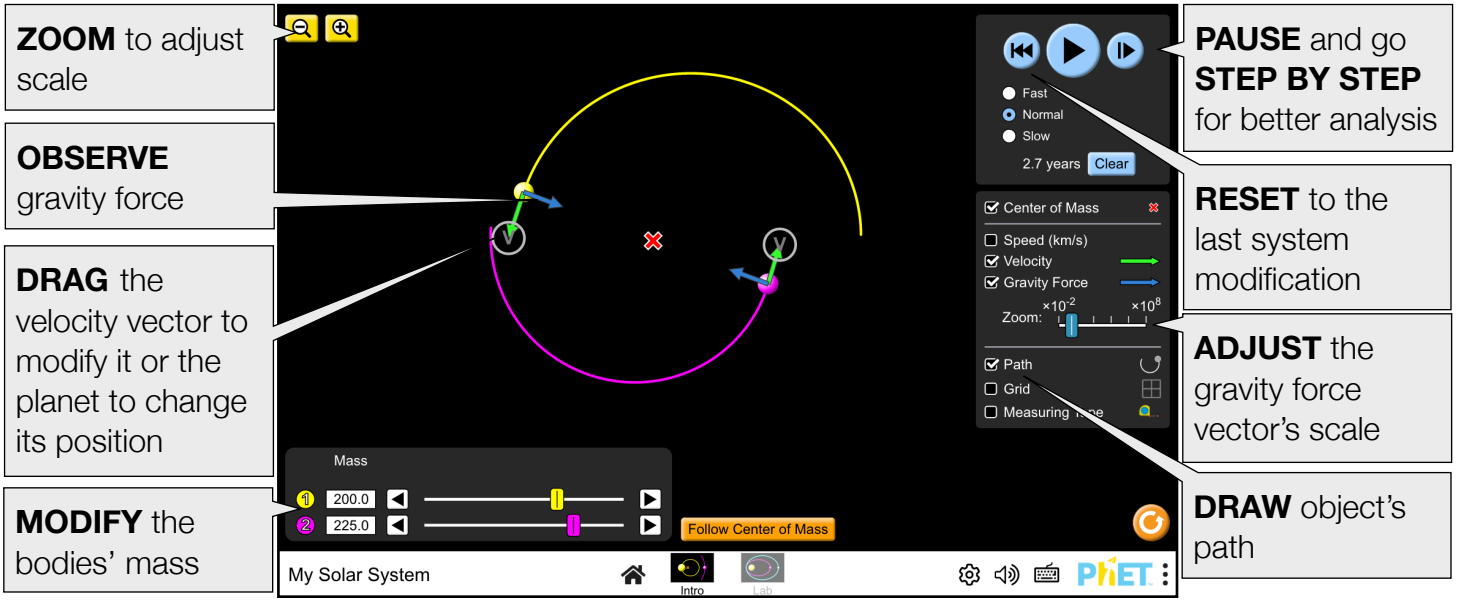
My Solar System

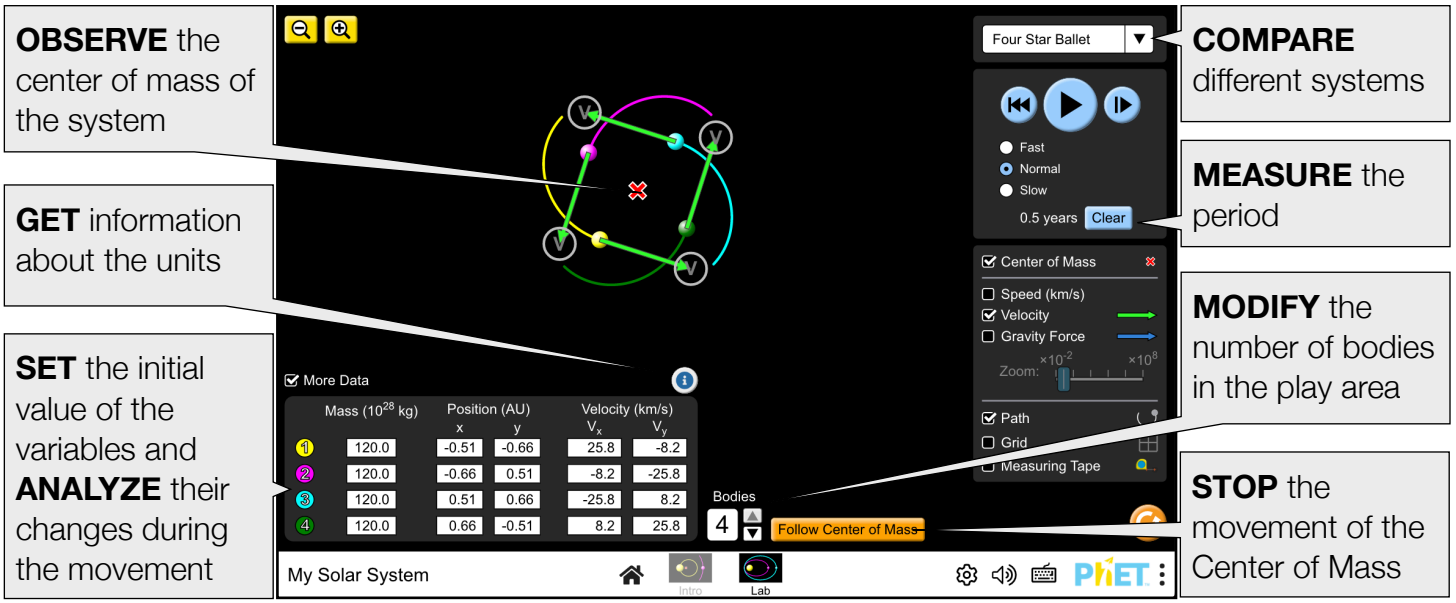
Intro Screen

Explore and analyze different trajectories that can be created with two bodies by modifying their position, mass, and velocity.



Lab Screen

Choose and study one of the eleven systems of planetary objects available. Analyze the position, velocity, gravity force, and trajectory of up to four bodies simultaneously.



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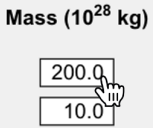
Insights into Student Use

- Students naturally want to build stable systems. Encourage them to find as many as possible.
- For a quantitative analysis of the changes in velocity and position throughout the trajectories, students may want to slow down or stop the bodies' movement in a specific position. To improve accuracy, use "Slow" (1) and pause and step forward (2) to incrementally analyze. (Note that the step size is smallest when "Slow" is selected.)

Complex Controls

Data Entry



- Students can modify the mass, velocity, or position values by clicking/tapping the readout.
- Type the desired value with your keyboard, or use the keypad provided on-screen.
- The allowed range appears on top of the keypad. The range for position corresponds to the default zoom level. Depending on the zoom level, you may not have full access to the entire play area when entering data from the keypad, and may need to manually move the bodies. When zoomed-in, it's possible to place bodies outside of the visible region, and you may need to zoom out to see them.

Return Bodies and Rewind Buttons

- The Return Bodies and Rewind Button have the same logic.
- Each time a body or velocity is moved or modified, a new state is saved. This state can be restored with the Rewind Button.
- The Return Bodies button appears when a body escapes the screen or a natural collision occurs.
- If a body is destroyed or escapes, the sim will no longer save new states. Then the buttons will return the bodies to their last values introduced by the user before a body is destroyed or scape.

Model Simplifications

- Many of the examples in our solar system (such as the Earth-Sun system) cannot be recreated in the simulation, due to limitations on the mass range. Students can build different systems with masses from 1 Jupiter mass to 1.5 Solar masses, which allows for building enough cases to understand planetary movements and interactions.
- In the Lab screen, the preset systems may not maintain their trajectories for a long time and may eventually crash. It is hard to program a model that keeps the stability of a multi-bodies system.
- Some of the smallest objects in the preset systems have a mass below the allowed range (displayed as ≤ 0.1). Such low masses were required to obtain the desired orbital dynamics of the preset.
- The original Flash version of My Solar System had no units. This HTML5 version of the simulation has the same macro behavior as the Flash version, but the numbers of the variables were rescaled to adjust the units used. To know more about the scaling and units see the Model Description.
- During a collision, the smaller body will disappear and transfer its entire momentum to the larger body. In this way, momentum is conserved, albeit in an unrealistic way. Collisions at this scale are complex, and modeling more accurate collision behavior such as gravitational reaccumluation was not a goal. For learning goals related to collisions, we recommend you use Collision Lab.

Customization Options

Query parameters allow for customization of the simulation, and can be added by appending a '?' to the sim URL, and separating each query parameter with a '&'. The general URL pattern is:
`…html?queryParameter1&queryParameter2&queryParameter3`

For example, in My Solar System, if you only want to show the 2nd screen (`screens=2`), and disable pan and zoom (`supportsPanAndZoom=false`) use:
https://phet.colorado.edu/sims/html/my-solar-system/latest/my-solar-system_all.html?screens=2&supportsPanAndZoom=false

To run this in Spanish (`locale=es`), the URL would become:
https://phet.colorado.edu/sims/html/my-solar-system/latest/my-solar-system_all.html?locale=es&screens=2&supportsPanAndZoom=false

⚙ Indicates this customization can be accessed from the Preferences menu within the simulation.

Query Parameter and Description	Example Links

`screens` - specifies which screens are included in the sim and their order. Each screen should be separated by a comma. For more information, visit the Help Center.	`screens=1`
	
	`screens=2,1`

`initialScreen` - opens the sim directly to the specified screen, bypassing the home screen.	`initialScreen=1` `initialScreen=2`
⚙ `locale` - specify the language of the simulation using ISO 639-1 codes. Available locales can be found on the simulation page on the Translations tab. Note: this only works if the simulation URL ends in "_all.html".	`locale=es` (Spanish) `locale=fr` (French)
⚙ `colorProfile` - changes simulation colors for easier projection.	`colorProfile=projector`
`audio` - if muted, audio is muted by default. If disabled, all audio is permanently turned off.	`audio=muted` `audio=disabled`
`allowLinks` - when `false`, disables links that take students to an external URL. Default is `true`.	`allowLinks=false`
`supportsPanAndZoom` - when `false`, disables panning and zooming using pinch-to-zoom or browser zoom controls. Default is `true`.	`supportsPanAndZoom=false`

Suggestions for Use

Sample Challenge Prompts

- Determine all the variables that affect the motion of the bodies.
- Build a system with elliptical orbits.
- Explain the meaning of "center of mass" and "follow the center of mass".
- Analyze the change in the gravity force during the movement of the bodies and describe how it affects the velocity.

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Inclusive Features

Sound and Sonification

- Differently pitched tones for each planetary body vary in volume based on their acceleration.
- Acceleration mapped tones do not play for planetary bodies that contain the system's center of mass.
- See the Sound Features Video for more useful tips on how concepts and sound are integrated in this sim. See the published Sound Design Documentation for more details on all sounds in this simulation.

See the simulation page for all supported inclusive features.

See all published activities for My Solar System here.
For more tips on using PhET sims with your students, see Tips for Using PhET.

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