Gravity3D shows the motion of bodies moving under the influence of gravity in three dimensions. Each "planet" is a sphere with an image mapped onto it. It has mass, position, spin and velocity. A planet's image is sized in proportion to its mass.

Swipe the screen to rotate the "universe". Pinch to enlarge or reduce the view.

Turn the device to the left to see a pair of images in stereo. A virtual reality viewer like Google Cardboard or Samsung Gear will help see the stereo effect. Turn the device to the right to see an anaglyph (red-green) stereo view. You will need red-green glasses to see the effect.

8000 times per second each planet's velocity and position are calculated based on the positions of the other planets. The mathematics is based on a highly precise method widely used in space physics (Runge-Kutta 4th order numerical integration).

The planets move at the rate you choose, either forward or backward in time as chosen by the slider at the bottom of the window. Each planet has a colored "tail" that shows where it has been.

When two planets get very close they collide, creating a new planet whose mass, momentum and spin are the sums of those of the planets that collided.

The app opens with one planet created with a random size and image. You may create more by tapping the + button. Each one is given a random location, velocity and image. Tapping the - button will remove the planet most distant from the center of mass of the group. The center of mass is always at the center of the screen.

The slider sets the rate of time flowing. It opens at zero. Moving the slider to the right goes forward in time. Moving to the left goes backward. The laws of physics have the same form whether time is positive or negative. When you reverse the flow of time, each planet will retrace its path almost exactly. Tiny deviations will occur because the calculations are very precise but not physically perfect.

An editor lets you set the position, velocity, mass, im-

age and tail color for each planet.

See a video of Gravity3D at: http://drowland.net/Physics/GMovie.mp4

Tags: physics, astronomy, computational geometry, virtual reality, 3D, iOS, mathematical astronomy, entertainment, education.

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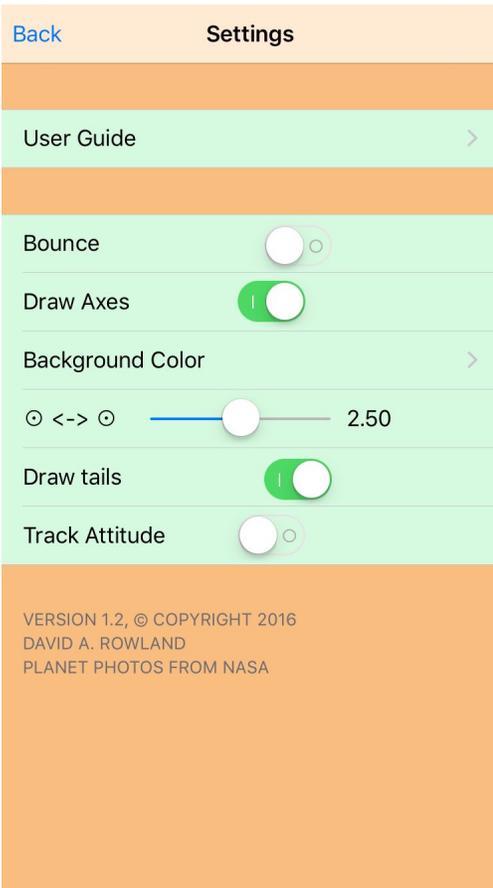January 8, 2018

To the Settings Menu

To the Edit Menu

To the list of clusters

Add a planet.
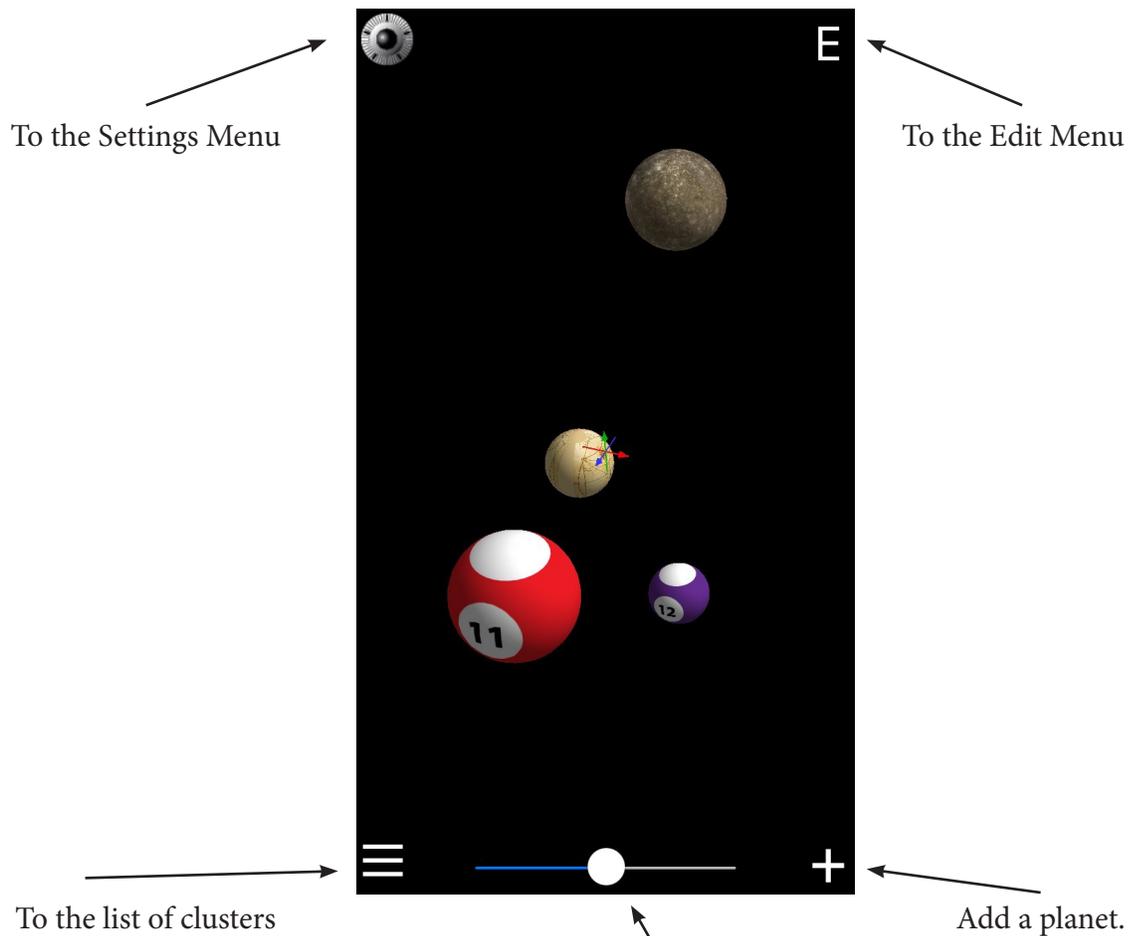
Control the passage of time. Center is zero. Positive time to the right, negative time to the left.

Double tap to make the controls disappear. Double tap again to make them appear. Swipe to rotate the "universe". Pinch to enlarge or shrink the view.

Each cluster contains zero or more planets. Choose the one you want to see. "+" creates a new cluster which is a copy of the selected cluster.

Turn the device to the left for a stereo view. Turn it to the right for an anaglyph stereo view (red - green, requiring colored glasses)

The Settings Menu

Bounce makes the objects bounce against each other rather than orbit arbitrarily close.

Draw Axes controls the display of the X,Y and Z axes in the center of the screen.

Background Color presents the color picker. You can give the background any color you like.

o <-> o sets the distance between the right and left stereo views. Units in inches.

Draw tails turns off and on the colored tails that show each object's path.

Track Attitude uses the device's gyro to move the objects as the device is moved. You can walk around them like VR.
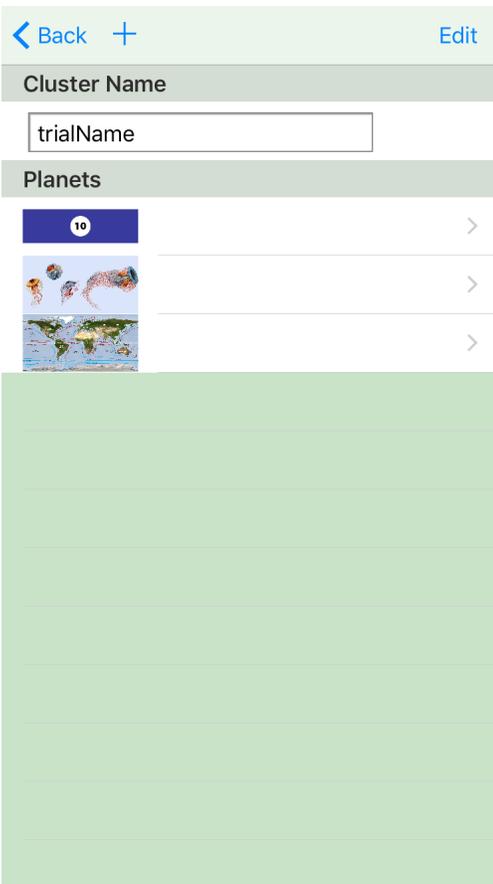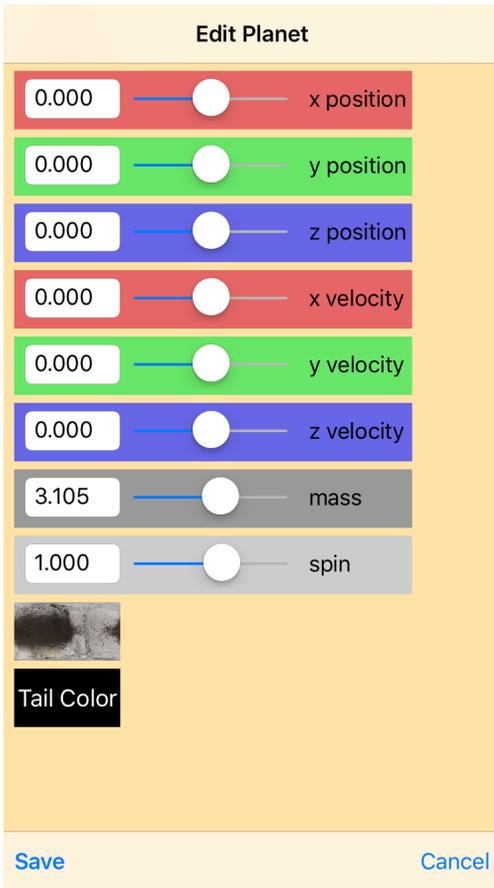
The Edit Menu

Choose the name of the cluster. You can add or remove planets from the list and from the display. Tap one to choose it for editing. + adds a new planet.

The Planet Edit Menu

Edit Planet	
0.000	x position
0.000	y position
0.000	z position
0.000	x velocity
0.000	y velocity
0.000	z velocity
3.105	mass
1.000	spin

Tail Color

Save   Cancel

Each parameter can be set by moving the slider or by tapping the text box, which will present the keyboard.. The planet's image and tail color can be changed.

Edit Planet	
0.000	x position
0.000	y position
0.000	z position

Choose Image

From App Collection

From Photo Library

From Camera

No Image

Cancel

4.77

2.27

Tail Color

Save   Cancel

Tap the image to present the chooser dialog. The image on a planet can come from a collection within the app, from your photo library or directly from the camera.
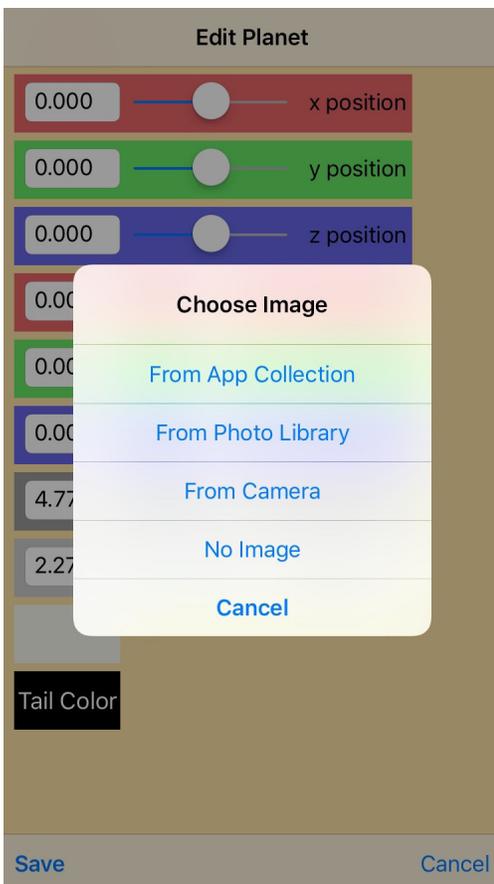
Color Picker

The color picker is used to set the background color. Colors are mod-
eled as a half sphere which rotates by swiping the screen. Overall
brightness is set by the slider. The check confirms the choice, the X
rejects it.