NASA'S SPACE JAM
Educator Guide

Have a blast learning about music, astronomy, and coding all at once! In these activities your learners will program planets to make music that is out of this world. By the end they'll be able to create their own musical solar system, complete with banging drums and spacey melodies. They can even use data of real planets and remix their song however they choose. Your learners will see how computer science can be used to learn about our universe and to be creative at the same time.

Here are the 8 lessons participants can be guided through. This activity can take from 45-75 minutes, depending on the total number of learners, the length of time allotted per step, etc.

Grades 2-5 notes: Younger audiences will need a little guidance to get started and some encouragement along the way. The step-by-step nature provided in the lessons should help, and you can take advantage of this by dividing the lessons into even smaller chunks for your learners, moving on to the next segments and lessons as attention permits. There will be terms that need some definition or further discussion to relate the lessons to coding concepts and also astronomical phenomena, such as periods of orbits — see our glossary for help with those terms.

Grades 6-9+ notes: For older learners, after completing all 8 lessons direct your learners to press the 'More!' button to explore pre-made musical versions of real solar systems. More advanced learners can also complete a bonus activity which lets them choose any real planetary system and perform simple calculations (division with a calculator) to create them on their own within the app. There are also complementary NASA Space Math activities that will pair well with this activity for a math extension (visit chandra.si.edu/sound/code)
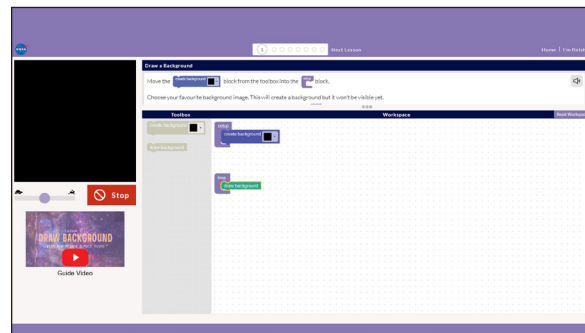
LESSON 1 DRAW A BACKGROUND

Move the create background block from the toolbox into the setupblock.

Choose your favourite background image. This will create a background but it won't be visible yet. To see your background, move the draw background block into the loop block and press Run.

The setup block will run every block within it once when the program starts.

The loop block will run every block within it over and over again while the program is running.
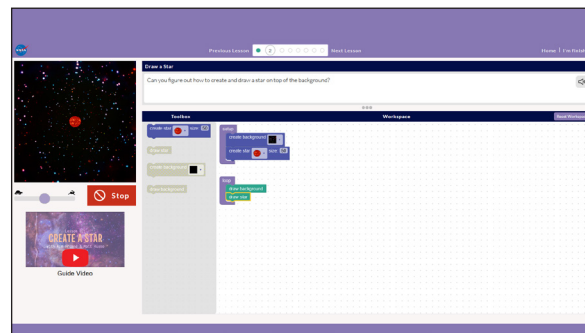

LESSON 2 DRAW A STAR

Connect the create star block to the setup block.

Then connect the draw star block within the loop button underneath the draw background block.

The blocks run in order from top to bottom. Draw the background before drawing the star on top of it. Now press run.

Explore the options for the star color and try changing its size.
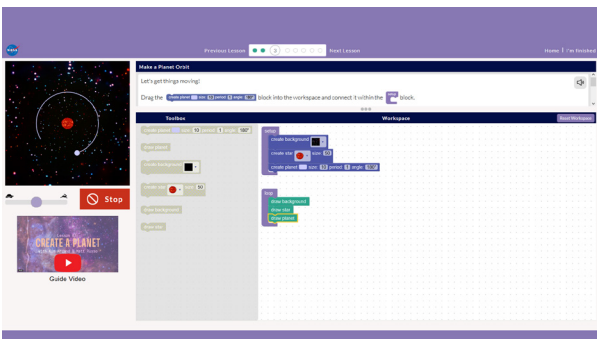

chandra.si.edu/sound/code
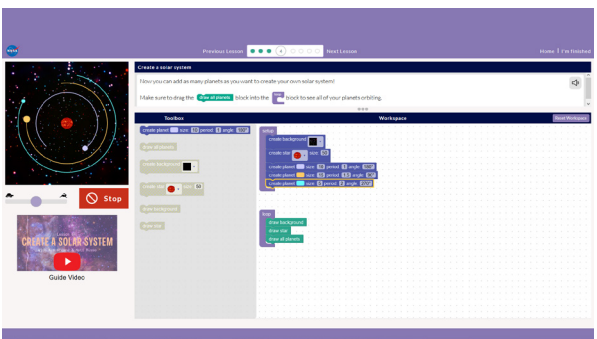
LESSON 3 DRAW A PLANET ORBIT

Drag the create planetblock into the workspace and connect it within the setblock.

To animate the planet's orbit you need to draw the background, the star, and the planet within the loop block. Try changing the size, period, and angle of your planet to see what effect they have. The orbital period of a planet is how long it takes to complete one orbit around its star. The orbital period of Earth is 1 year.

LESSON 4 CREATE A SOLAR SYSTEM

Now you can add as many planets as you want to create your own solar system! Make sure to drag the draw planets block into the loopblock to see all of your planets orbiting.
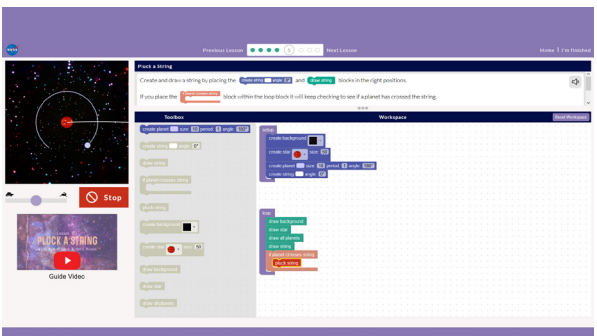

LESSON 5 PLUCK A STRING

Create and draw a string by placing the create string and draw string blocks in the right positions.

If you place the if planet crosses string block within the loop block it will keep checking to see if a planet has crossed the string.

Place the pluck string within the when block to see the string get plucked.
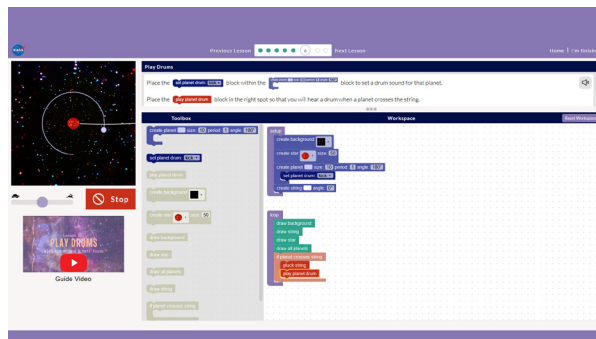

LESSON 6 PLAY DRUMS

Place the set planet drum block within the block to set a drum sound for that planet.

Place the play planet drum block in the right spot so that you will hear a drum when a planet crosses the string.

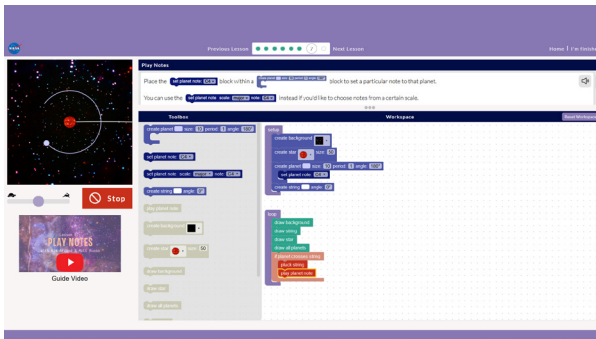Add a few more planets to create a beat! The size of the planet controls the volume of its drum.

LESSON 7 PLAY NOTES

Place the set planet noteblock within a create planet block to set a particular note to that planet.
You can use the set planet note scale instead if you'd like to choose notes from a certain scale.

Place the play planet note block in the right spot so that you will hear a note when a planet crosses the string.

The size of the planet controls the volume of its note.

LESSON 8 CREATE YOUR OWN SPACE JAM

Combine planets with drums and notes to create your own planetary symphony!

You can also add multiple strings!

GLOSSARY

Star: A glowing ball of gas held together by its own gravity and powered by nuclear fusion in its core.

Planet: One of eight major bodies that orbit the Sun, visible to us by reflected sunlight.

Exoplanet: A planet outside of our solar system.

Orbit: The path of an object in space around a star, planet, or moon. Eg., "Earth's orbit around our Sun"

Orbital Period: The period, or orbital period, of a planet is how long it takes to complete one orbit.

Scale (musical scale): An ordered sequence of notes, it can be used as building blocks to make a melody or song.

Octave: In music, the jump between one musical pitch and a higher or lower pitch with the same name. Eg. C4 is one octave higher than C3.

FREE RELATED ACTIVITIES & RESOURCES WE OFFER:

http://chandra.si.edu/binary
Learn the basics of binary code with interactive and at-home activites.

http://chandra.si.edu/code
Using data from the Chandra X-ray Observatory and other satellites on exploded stars, star-forming regions, and black holes, you'll learn basic coding.

http://chandra.si.edu/3dprint
Learn to create objects in our Universe through 3D printing.

http://chandra.si.edu/tinkercad
This activity series will take you through the basics of 3D modeling in astronomy using the free browser-based software Tinkercad.

http://chandra.si.edu/vr
A three-dimensional virtual reality (VR) with augmented reality (AR) version of 3D data allows you to walk inside the debris from a massive stellar explosion, as well as other astronomical objects.

http://chandra.si.edu/women/ar
A free augmented reality app that highlights women who have had an impact on STEM fields.

http://chandra.si.edu/sound
This sonification project allows listeners to hear translations of space data into sound.

http://chandra.si.edu/make
This site houses hands-on activities that can be done without a computer using mostly paper materials.

chandra.si.edu/sound/code