Curriculum Guide

Picnic Planet: A Lunchtime Guide to Your Galaxy's Exoplanets by Asa Stahl, illustrated by Nadia Hsieh
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Lexile Level: 360. STEM title, astronomy, biology, earth science. physics Guided Reading Level N Grade level equivalent 3, Grade level interest 1-5; Teks Grade 2, 110.13, 112.13; Grade 3 110.14, 112.14; Grade 4 110.15, 112.15 CCSS skills: Literacy, Foundational, Writing; CCSS strands RF3.3, 3c,4a, 4b, 4c, RI 3.1,2,3,4, 6, 7, 8, 9, 10, L.3, 3, 4, 4a, 4c, 5, 5a, 5b, 5c, 6, SL 3.1, 1c, 1d, 2, 3, 4,5, 6, W 3.1, 2, 3, 4, 7, 8, 10. Next Generation Science Standards: 5- PS2-Motion and Stability: Forces and Interactions, 3-LS4-Biological Evolution: Unity and Diversity, 3-ESS2-Earth's Systems Educational Description: STEM Content, simple informative text, narrative prose, Physical & Earth Science Content; Exoplanets, a story of the universe, illustrations and varied font enhance meaning and tone, figurative language: simile, metaphor; Comprehension strategies: Sequencing events, compare and contrast, make inferences and draw conclusions, ask and answer questions. Back Matter: Author's Note, About the Author. Theme: Our Universe.

Description: *Picnic Planet* presents several actual exoplanets, giving a sense of other worlds besides our own, some of which might develop their own forms of life.

For your convenience, a list of relevant links is listed at the end of each activity.

Activity 1: Planets. Ask each of your students to imagine their very own planet, letting them make it as weird and outlandish as they want. Is it made of something special? Does anyone live on it? What color is its sky? What sort of star does it go around? Does it have any moons? What are they like? When they’re done, make sure they give it a name!

Now tell them about some of the coolest planets that have been discovered, including those shown in this book, and see if fact isn’t stranger than fiction in some way:

- PSR J1719-1438 b, planet that orbits its star in 2 hours
- Fomalhaut b, planet that orbits its star in 700 years
- Kepler-189 b, planet that is likely the leftover core of a planet whose atmosphere evaporated away
- 51 Pegasi b, planet that’s about as big as Jupiter but 5x closer in to its star than Mercury is to the Sun
- The TRAPPIST-1 system, seven planets that all fit within Mercury’s orbit
- Kepler-452 b, Kepler-62 f, Kepler-22 b, three of the most Earth-like (and so potentially life-hosting) planets known

NASA has released vintage-style travel posters for some of these exoplanets that are perfect for hanging in the classroom[1]. Consider having your students make posters for their own planets, as well.

Finish up by telling your class they can go discover a planet tonight, if they're lucky! The NASA project *Planet Hunters*[2] allows anyone to look through space telescope observations of stars and try pick out planets. It's free, easy to use, and every star that's looked over helps a major scientific endeavor.

1. https://exoplanets.nasa.gov/alien-worlds/exoplanet-travel-bureau/
2. https://planethunters.org

Activity 2: Galaxies. Use beautiful photos of space to teach your students about galaxies.

Start by dissecting the different parts of Andromeda, the closest galaxy to us, with one of the famous tilt-shift images that make it look like a sparkling jewel[1]. Point out the myriad stars (there are about 1 trillion), the bright core made up of stars surrounding an invisible supermassive black hole, and the violet haze of hydrogen that suffuses all the space between.

Move on to galaxies in general, picking apart their similarities and differences. Elliptical types like NGC 3610[2] may not even look like galaxies at first glance, while spiral types like the Whirlpool Galaxy[3] are much closer to the idea people usually have in mind. Use the latter to provide a sense of what it means for us to live in a spiral arm of the Milky Way, then bring that home by showing what the Milky Way looks like from Earth (viewed side-on) with long exposure photos of the night sky[4].

Let your class explore the galaxy zoo. Wow your students with images of some of the more unusual galaxies, like the Cartwheel Galaxy[5], the Antennae Galaxies[6], and Hoag's Object[7]. Lastly, finish off by giving them a sense of scale with the Hubble Ultra Deep Field[8] or the Hubble Legacy Field[9] – highly sensitive images with thousands of galaxies fit into a tiny fraction of the sky.

1. https://imgur.com/gallery/8G83LNK
2. https://www.spacetelescope.org/images/potw1546a/
3. https://www.nasa.gov/feature/goddard/2017/messier-51-the-whirlpool-galaxy
4. https://apod.nasa.gov/apod/ap100823.html
5. https://www.nasa.gov/image-feature/goddard/2018/hubble-s-cartwheel
6. https://apod.nasa.gov/apod/ap140316.html
7. https://www.nasa.gov/multimedia/imagegallery/image_feature_1747.html
8. https://spacetelescope.org/images/heic0406a/
9. http://hubblesite.org/image/4492/news

Activity 3: Scientific Questions. Have your students apply the five questions of journalism (Who? What? Where? When? Why?) to themselves. Encourage them to be as objective as possible - the point is to push them to think reductively and synthesize knowledge from different branches of science. In order to get them on the right track, consider answering one of the simpler questions, like Where are you? or When are you? in front of the class.

"Where are you?" is a good question for teaching basic geography and astronomy – you are in this town, in this country, in this world, around this star, in this galaxy. If the students are interested, pull up a map of the local universe[1] and describe the filamentary shapes that galaxy clusters make and the large, incomprehensibly empty voids between them.

“What are you?”points most straightforwardly to human biology, but can be pushed deeper to chemistry, and even deeper into physics (progressing from organs, to cells, to chemicals, to atoms).

“When are you?” helps teach basic astronomy and geology. Since we don’t know what, if anything, came before the singularity, the universe could be infinitely old. But we know that it has been roughly 14 billion years since the singularity, that the Earth and Sun formed 4.5 billion years ago, humans emerged on Earth around 200,000 years ago, and that civilization began somewhere around 10,000 BC.

“Who are you?” is mostly a question of identity and psychology, and should be as easy as the class allows it to be.

“Why are you?” is a question for philosophy and religion. It may be the most controversial, but it is at least as important a question as all the others. If you do choose to ask it, consider assigning these questions as homework so that students can talk with their parents about it and keep their answers to themselves.

1. http://www.atlasoftheuniverse.com/nearsc.html

About the Author
Asa Stahl is an astrophysicist who loves to make science interesting for the youngest readers. His previous book with Creston was the award-winning *The Big Bang Book*. His research seeks to answer questions like just how rare is a planet like Earth? And how did we get here?

About the Illustrator
Nadia Hsieh uses art to tell stories.Her previous book, a Eureka Silver medal winner, was *Eighteen Vats of Water*, about the art of calligraphy and two of its most famous practitioners in Chinese history.