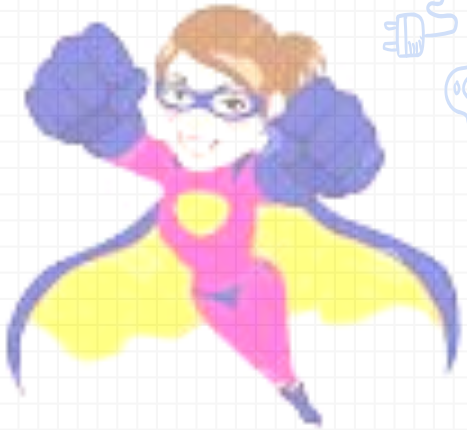
Exoplanets!

Planet Discovery in the Age of Kepler



WELCOME!

OBJECTIVES FOR TODAY:

1. Intro to Yoram's research
2. Intro to Sam and Adam's research
3. LUNCH!
4. Examples of how to bring Exoplanet research into your classrooms
5. Adam's hands-on example

OBJECTIVES FOR TOMORROW:

1. Hands on activity with Sam
2. LUNCH!
3. Lesson Planning for YOUR classes (gallery walk)
4. Discussion of Student Projects

Dr. Yoram Lithwick

Assistant Professor, Physics and Astronomy


H2O
√2
E=mc²
H2O
√2

Exoplanets and Social Media!

Katie and Sam

Overview

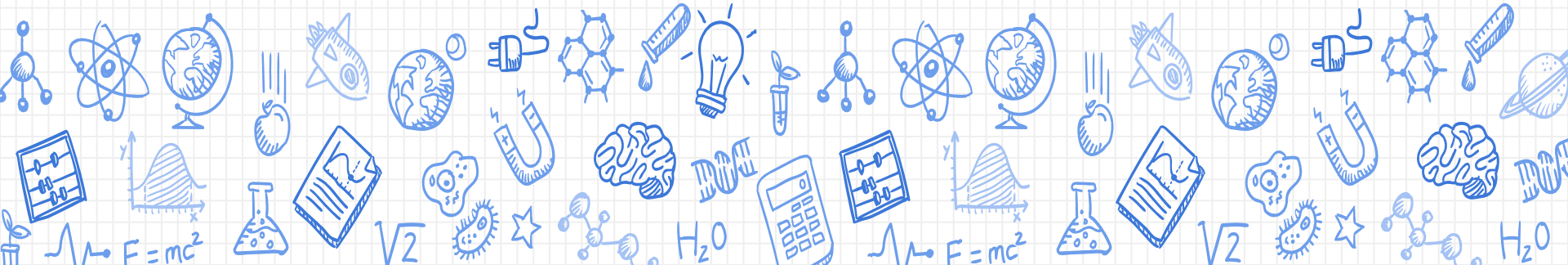
Students get an INTRO TO EXOPLANETS and begin to relate exoplanet to life here on Earth.

- **orbital period**
- **temperature**
- **transit**
- **relative size**
- **habitable zone**

Ideas for final project:
FACEBOOK, SCHOOLOGY, EDMOTO, discussion threads, powerpoint templates

Exoplanet App or Website

- Pick a group of planets
- Assign or let them pick
- Time to navigate app/ data



4-6 class periods

Day 1: research, read discovery paper, explore Exoplanet App

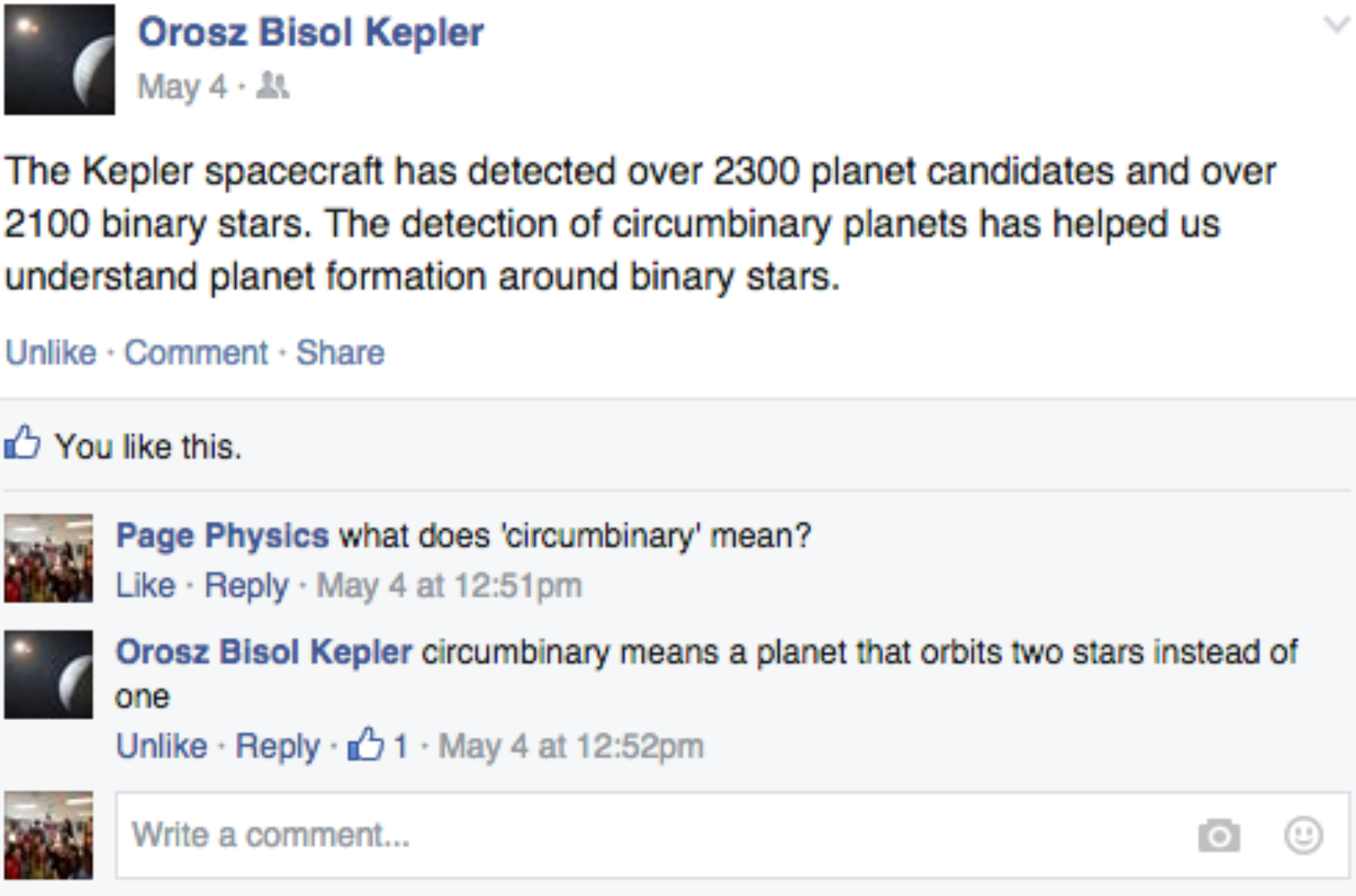
Day 2: NETLOGO and MATHEMATICA computational models in computer lab

Day 3: Facebook page work

Day 4: work time/start presentations

Day 5: finish presentations Tweet out #exoplanet

Sample finished products



Orosz Bisol Kepler
May 4 ·

The Kepler spacecraft has detected over 2300 planet candidates and over 2100 binary stars. The detection of circumbinary planets has helped us understand planet formation around binary stars.

Unlike · Comment · Share

You like this.

Page Physics what does 'circumbinary' mean?
Like · Reply · May 4 at 12:51pm

Orosz Bisol Kepler circumbinary means a planet that orbits two stars instead of one
Unlike · Reply · 1 · May 4 at 12:52pm

Write a comment...

Orosz Bisol Kepler

May 4 ·

24 minutes til the New Year! — 🎉 celebrating another year.

Unlike · Comment · Share

You like this.

Write a comment...

Orosz Bisol Kepler

May 4 ·

enjoy 7.3 birthdays per Earth Year you'll get to 21 seven times as fast #partaaaayyyy #0to100realquick

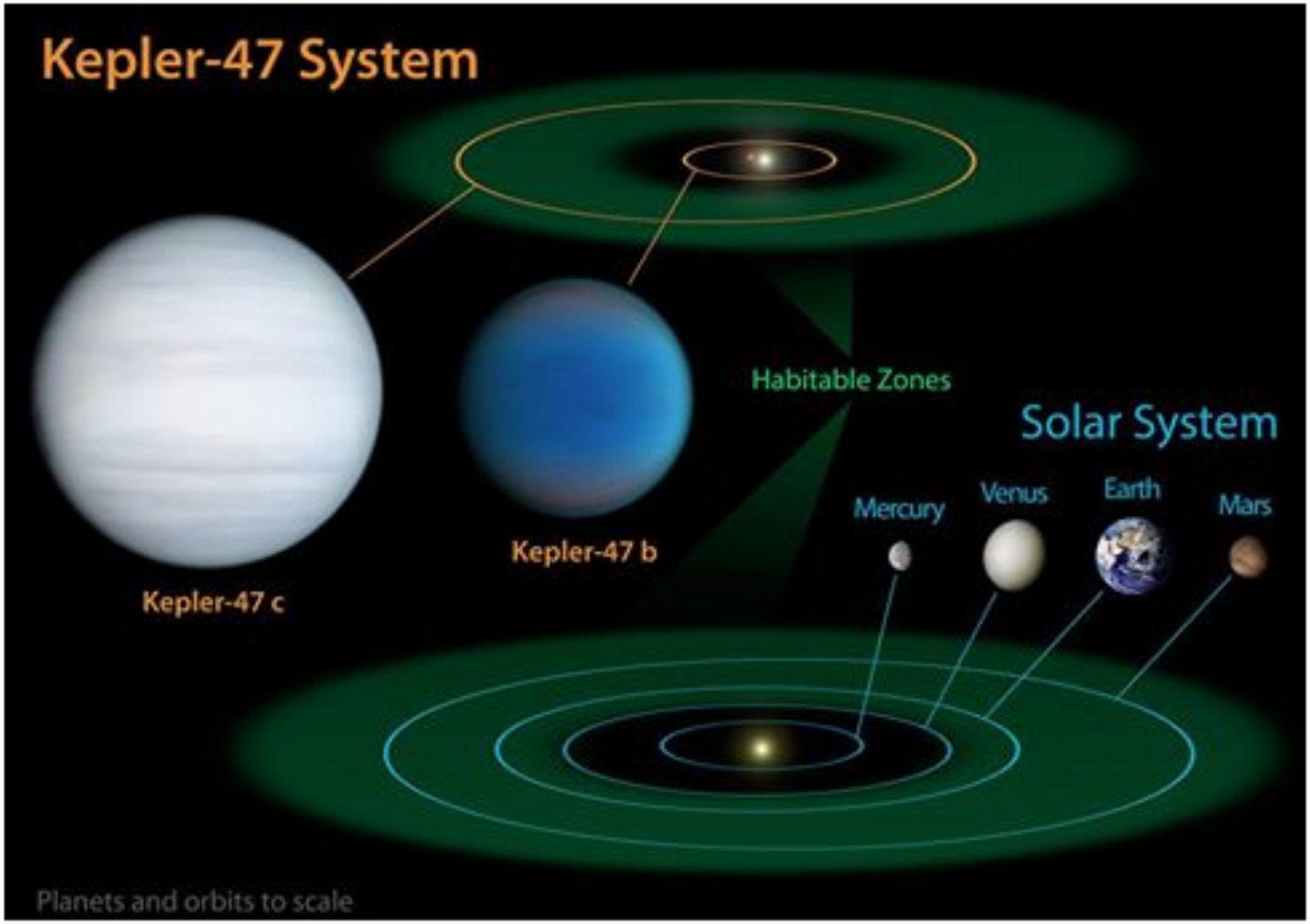
Like · Comment · Share

Write a comment...

Orosz Bisol Kepler

April 27 · Edited ·

jus chillin outside the habitable zone #rebel #noragrets



Page Physics

April 27 ·

Orosz Bisol Kepler How did you come up with your name?

Like · Comment · Share

Orosz Bisol Kepler Orosz is the main founder of Kepler-47, and Bisol means 2 suns

April 27 at 12:29pm · Unlike · 1

Write a comment...

Page Physics

April 27 ·

Hi Gaea Kepler where'd you get such a cool name?

Like · Comment · Share

Balboa Kepler Tenb and Gaea Kepler like this.

Gaea Kepler From the Greek Earth Mother.

April 27 at 8:08am · Unlike · 1

Write a comment...

Vulcan HDb

May 4 at 12:28pm ·

The Blackhawks destroyed the Wild one year ago today in the first game of the series. (3 days for people on Earth)

Unlike · Comment · Share

You like this.

Write a comment...

Kepler Imfeeling Twentytwob

May 4 ·

feeling so bloated omg. I'm currently 2.5x the size of Ea Rth XP

Unlike · Comment · Share

You like this.

Page Physics lol

Like · Reply · May 4 at 7:52am

Write a comment...

Kepler Imfeeling Twentytwob

May 4 ·

i thought i was a rocky planet, but after that quesarito from Taco Bell, I'm starting to think i may be a gassy planet

Like · Comment · Share

Kepler Eleveng likes this.

Kepler Eleveng i feel that

Like · Reply · 1 · May 4 at 8:10am

Write a comment...

Jaurina Sillooski

May 11 ·

I'm soooo hot, hum for my digits if you want them. My surface temperature number is 5636±100 K!

Like · Comment · Share

Jaurina Sillooski

May 11 ·

Monday, May 11, 2015 at 7:48am

I believe I am st habitable out of all the planets..... Except Earth xD

Like · Comment · Share

Jaurina Sillooski

May 11 ·

Just a few hours til my next birthday, WOO!

Like · Comment · Share

Write a comment...

Jaurina Sillooski

May 11 ·

BRUH my sister is literally so annoying. She keeps orbiting me every 7.45 earth days. Like HUH....?¿

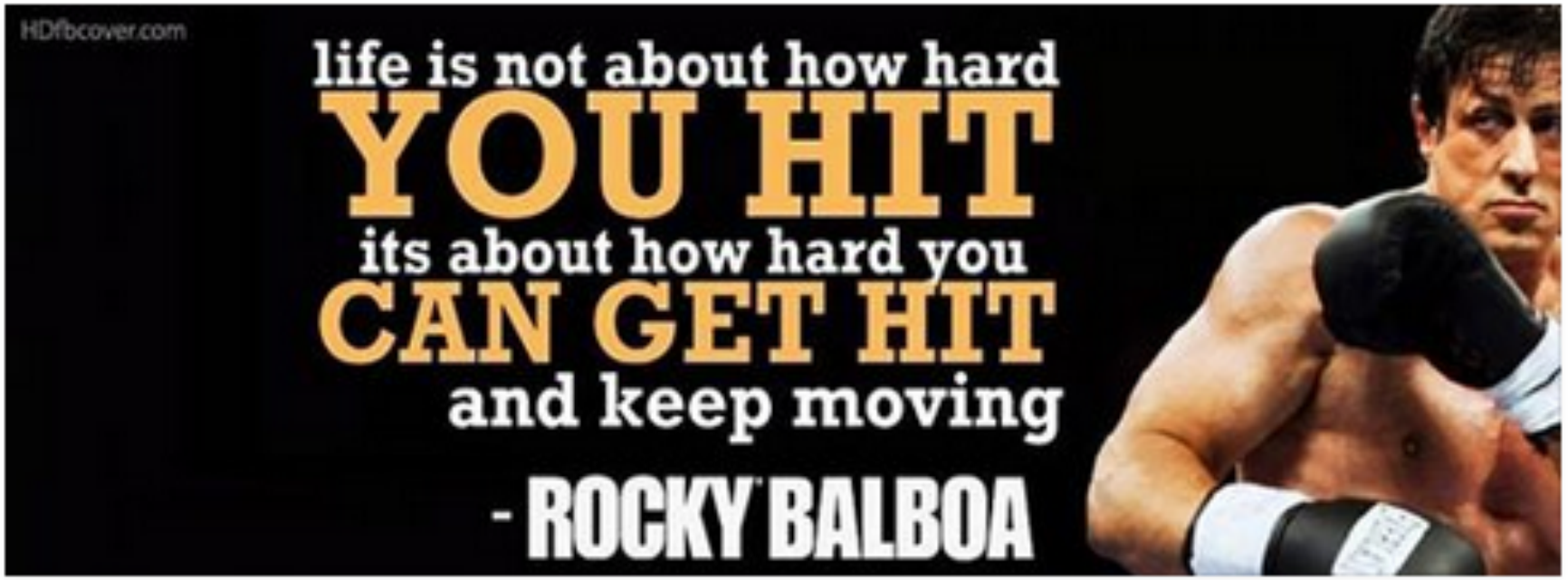
Like · Comment · Share

Write a comment...

Balboa Kepler Tenb

May 4 ·

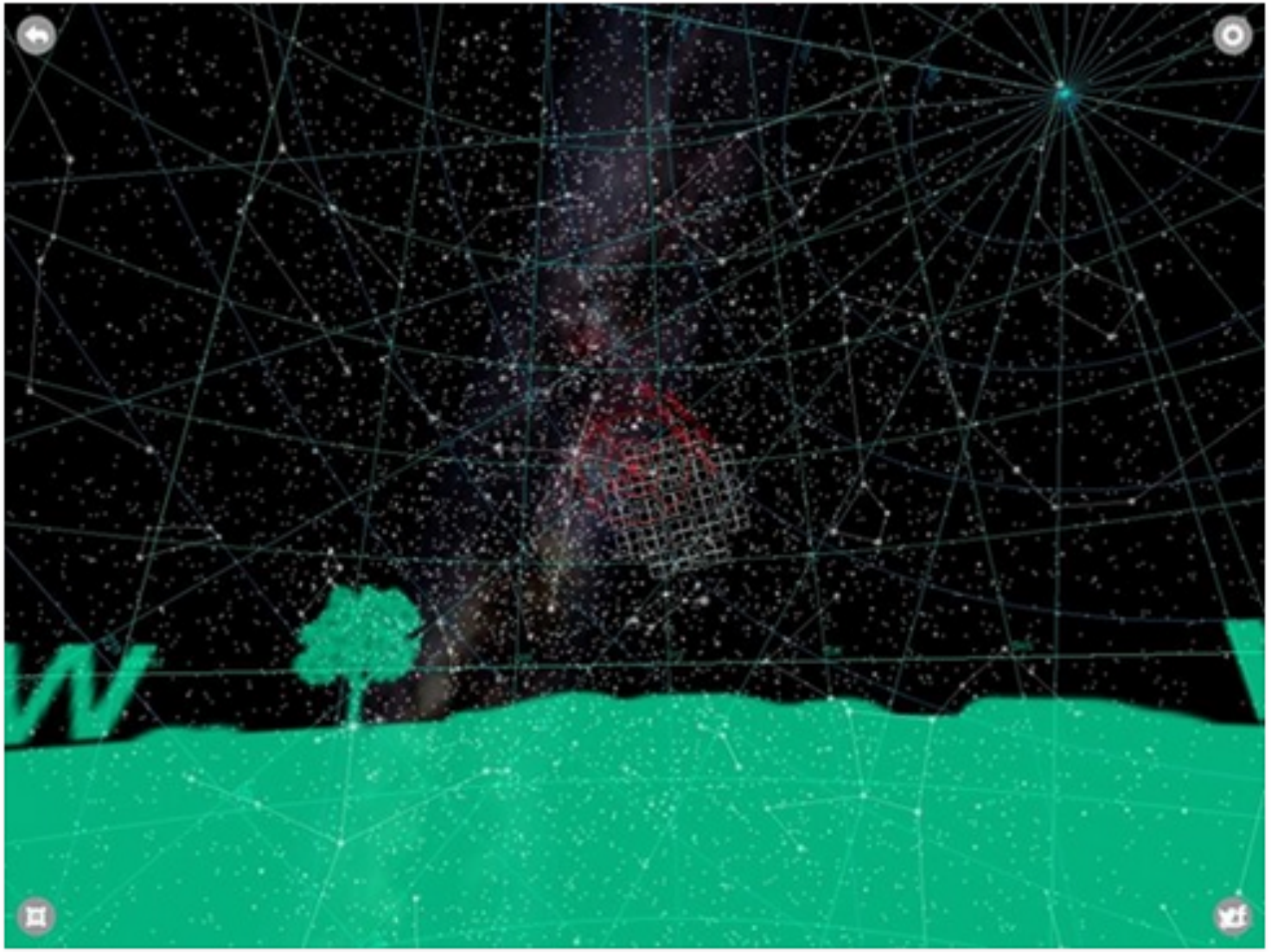
Balboa keeps moving! A full orbit takes about .84 days!



Kepler Ames Oneeightysix

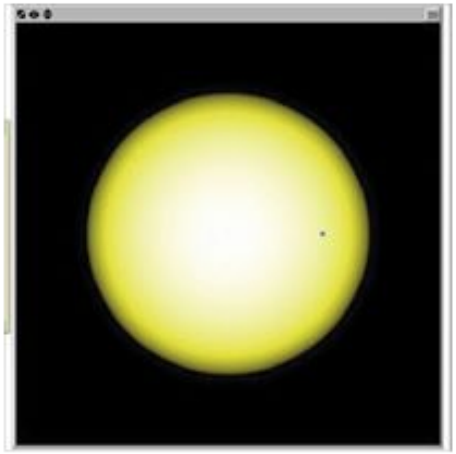
May 11 ·

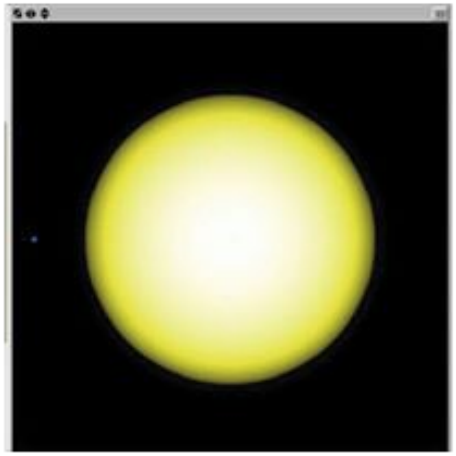
This is where I am located relative to you!

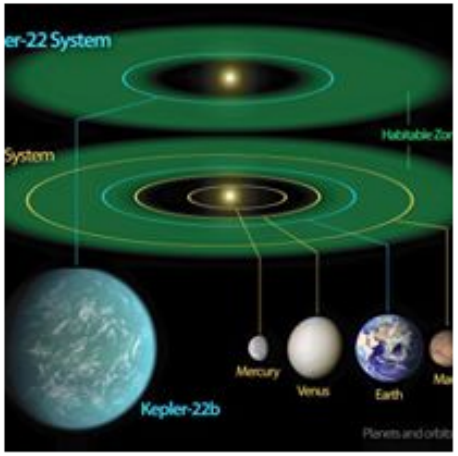


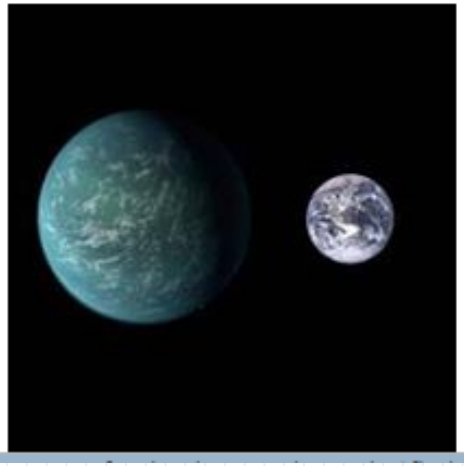
Photos

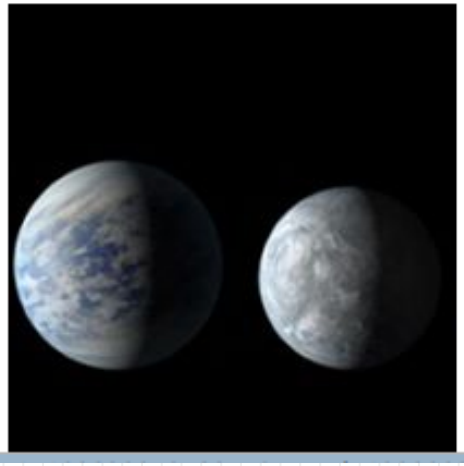
Kepler's Photos Albums

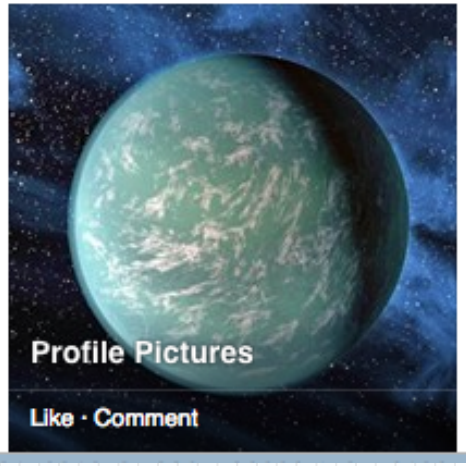








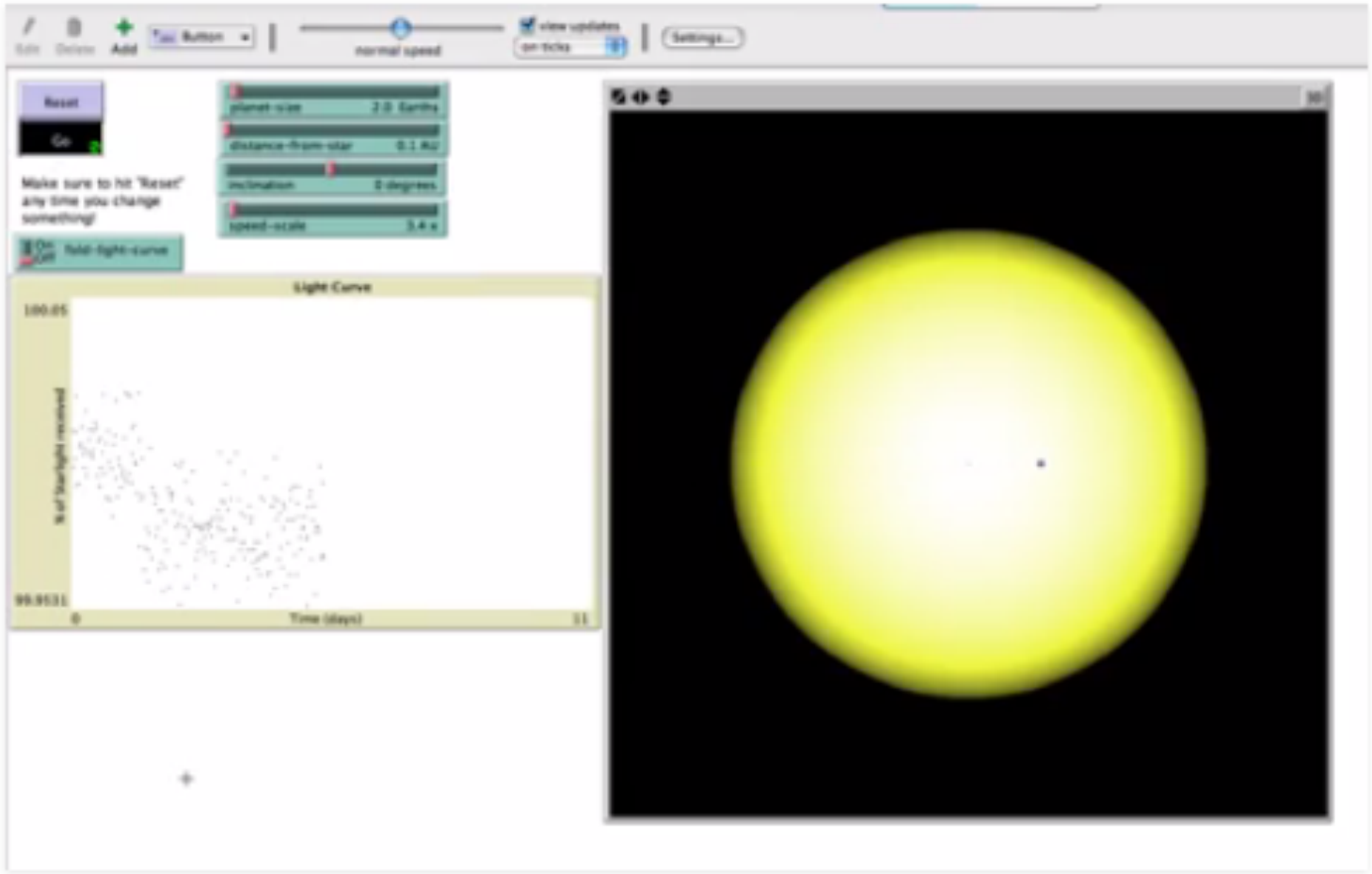




Kepler Ames Oneeightysix uploaded a new video.

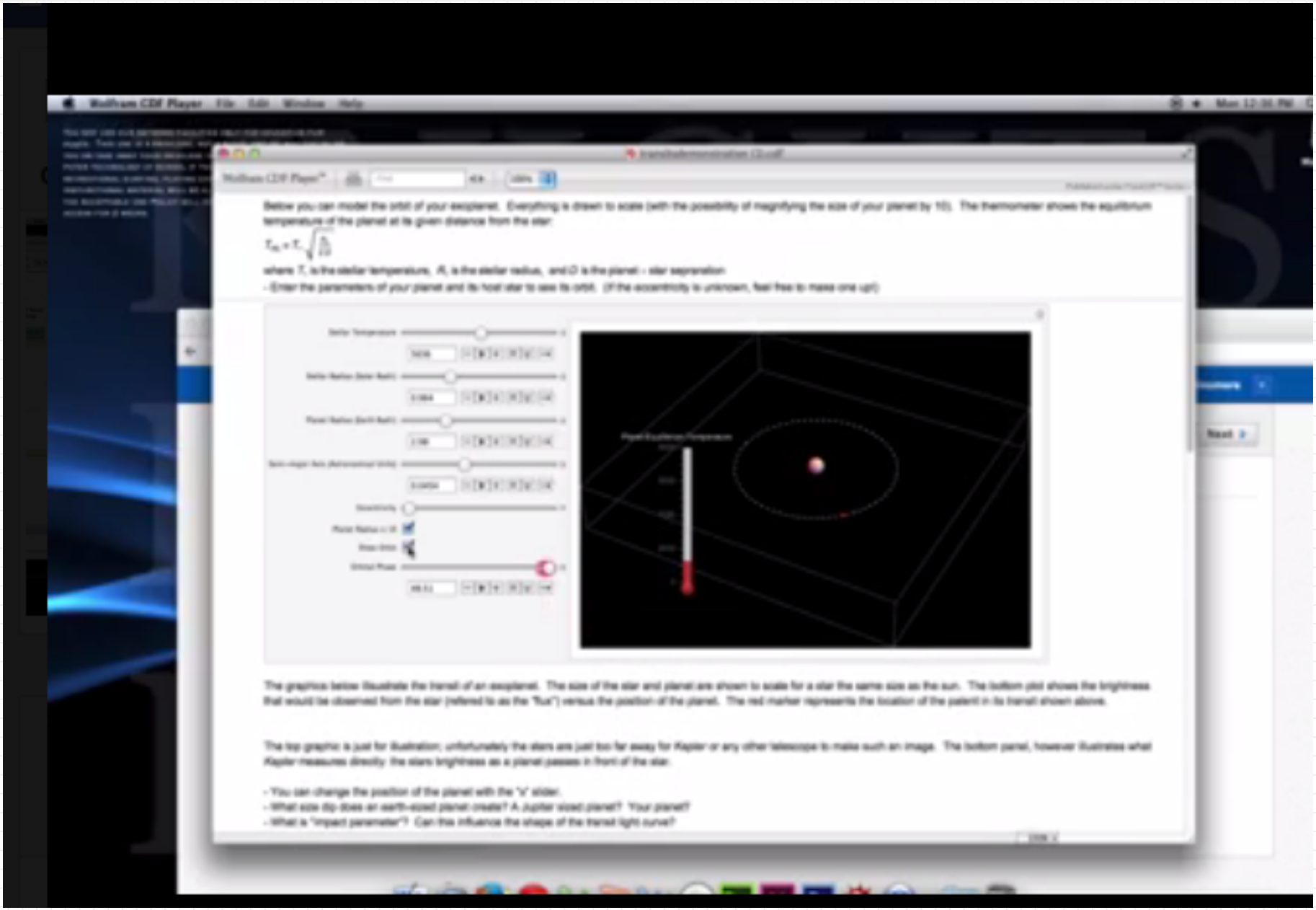
May 4 ·

heres my light curve



3 Views

Unlike · Comment · Share


Wolfram CDF Player
File Edit Window Help
Below you can model the orbit of your exoplanet. Everything is drawn to scale (with the possibility of magnifying the size of your planet by 10). The thermometer shows the equilibrium temperature of the planet at its given distance from the star.
where T* is the stellar temperature, R* is the stellar radius, and a is the planet - star separation
- Enter the parameters of your planet and its host star to see its orbit. (If the eccentricity is unknown, feel free to mess one up!)
Stellar Temperature
Stellar Radius (Solar Radii)
Planet Radius (Earth Radii)
Semi-major Axis (Astronomical Units)
Eccentricity
Planet Radius in 3D
Show Orbit
Orbital Phase
Planet Equilibrium Temperature
The graphics below illustrate the transit of an exoplanet. The size of the star and planet are shown to scale for a star the same size as the sun. The bottom plot shows the brightness that would be observed from the star (referred to as the "flux") versus the position of the planet. The red marker represents the location of the patent in its transit shown above.
The top graphic is just for illustration; unfortunately the stars are just too far away for Kepler or any other telescope to make such an image. The bottom panel, however illustrates what Kepler measures directly: the stars brightness as a planet passes in front of the star.
- You can change the position of the planet with the "x" slider.
- What size dip does an earth-sized planet create? A Jupiter sized planet? Your planet?
- What is "impact parameter"? Can this influence the shape of the transit light curve?
Next

http://astro.unl.edu/naap/esp/animations/transitSimulator.html)

Interstellar Travel Agency

WE WANT TO REPRESENT YOU!

1. PICK A PLANET
2. Name it
3. Write a short Advertisement to promote your planet to space travelers everywhere!

*8 sentences or LESS
*relate to life here on Earth (where the Agency is)
*Discuss ORBITAL PERIOD, temperature, system, host star, etc...

Adam Mahlon Dempsey

PhD Student. Reach for the Stars

GK12 Fellow.


H2O
√2
E=mc²
H2O
√2

KWL

What I Know	What I Want to Know	What I Learned
*ways you use astronomy *units that might work *student groups to include *best recipe for cookies :)	umm…. what?	Yoram Sam Adam List one thing you learned about Exoplanets today!