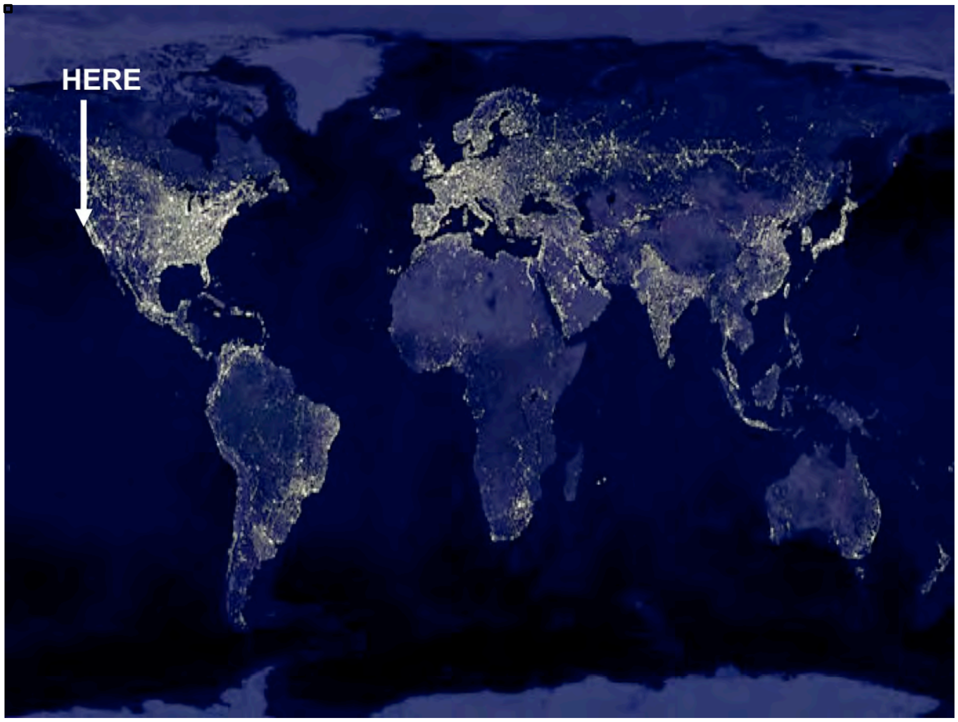
I thank Bob McBarton for arranging this opportunity to speak with you today.

While you enjoy lunch, I'd like to invite you to change your perspective. While that often means, "I'd like you to take my side of an argument", today I'm talking about something much bigger.

Consider your place in the cosmos – where are you? Where are we?

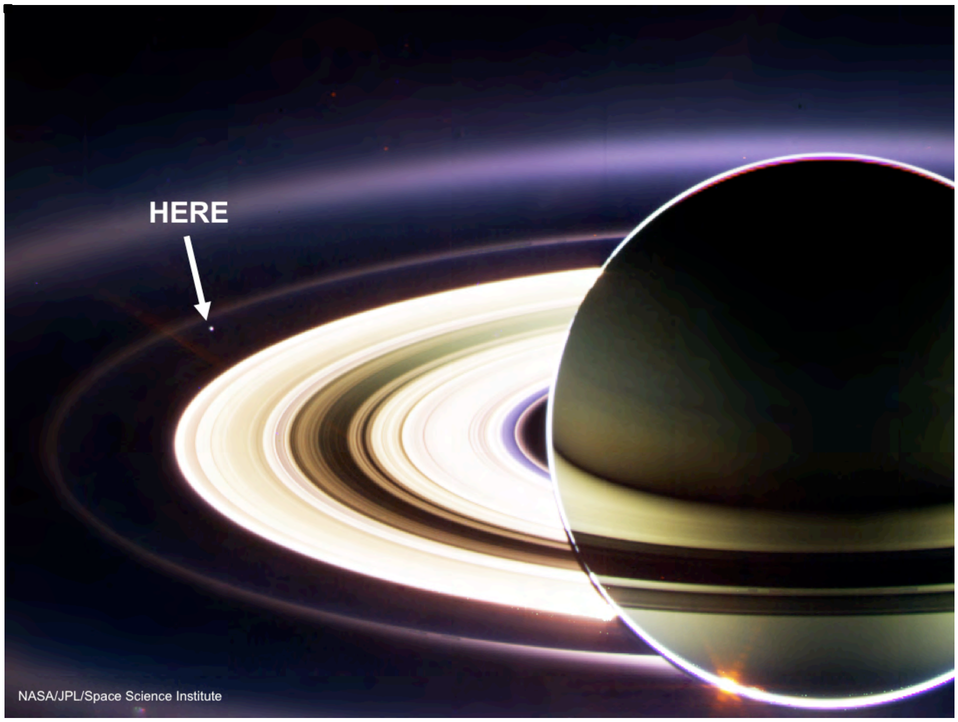
Well, delightfully, we are HERE

Thanks to Google Earth, most of us are comfortable with the idea that we are HERE



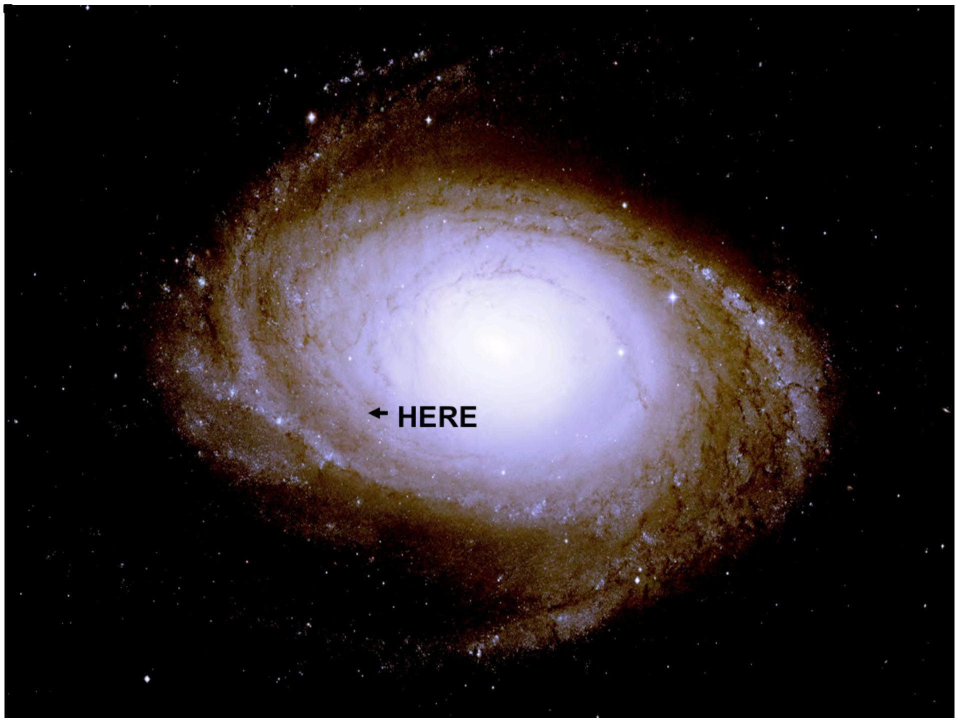
From the altitude of low Earth orbit, we are HERE

Since astronaut Bill Anders took this photo from the lunar orbit in 1968, we've begun to appreciate that we are HERE



The Cassini spacecraft orbiting Saturn looked back and saw us … HERE

In 1990 as Voyager 1 passed Neptune, it turned homeward to see us …HERE



We are … HERE

Orbiting one of the 400 billion stars in the Milky Way Galaxy.

And ultimately … HERE.

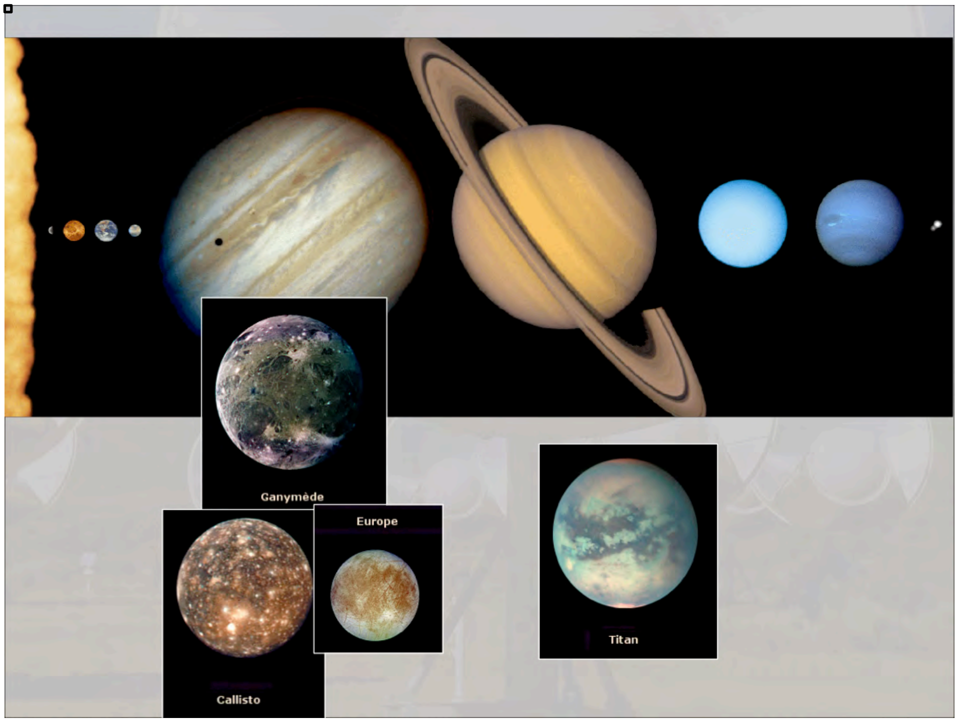
Within one of the 100 billion galaxies in the observable universe, which by the way, represents only about 4% of the total mass/energy of the cosmos.

We live on a fragile island of life in a universe of possibilities.

This remarkable image is another possibility.

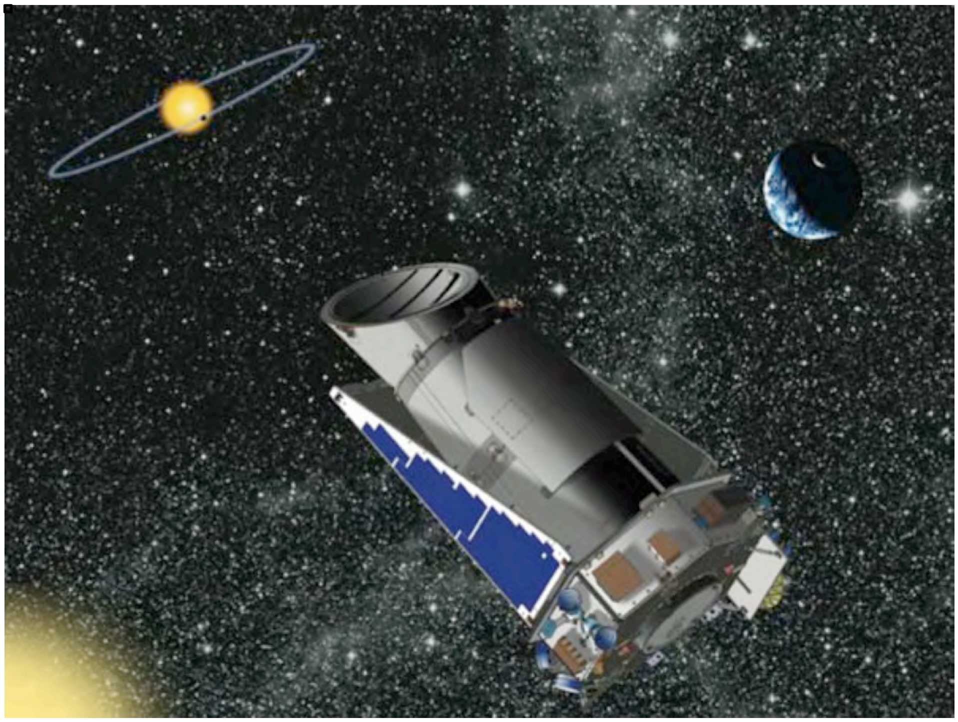
These isn’t the sandy cliffs near Pt. Reyes, this is our neighboring planet Mars, as seen up close and personal by the Curiosity Rover

We are curious about whether life ever existed here, or might still do so today - in liquid acquifers protected beneath the surface.



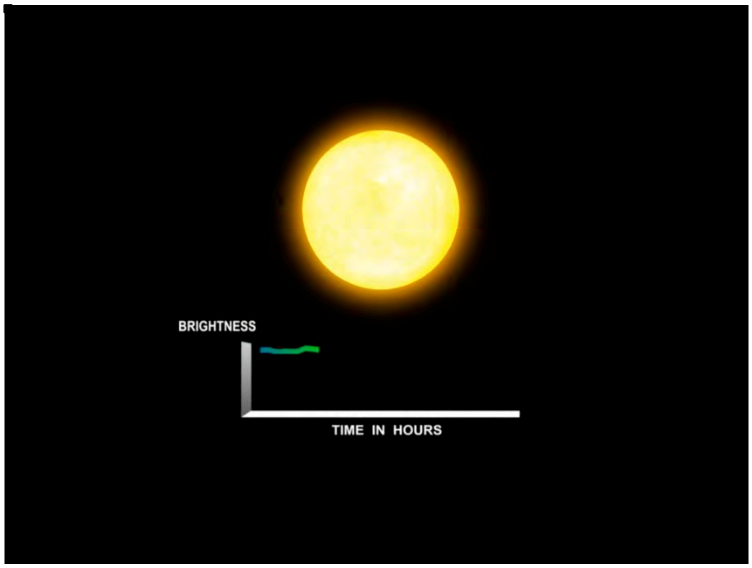
Alternatively, life might be found further out in our solar systems in the water oceans beneath the ice on Europa, Calisto, and Ganymede – large moons of Jupiter, or in the ethane lakes on the surface of Saturn's large moon Titan.

But what about planets beyond our own solar system?



After 25 years of preparation, NASA launched the Kepler spacecraft in March of 2009. Recently, Kepler has begun to show us just how rich those possibilities actually are.

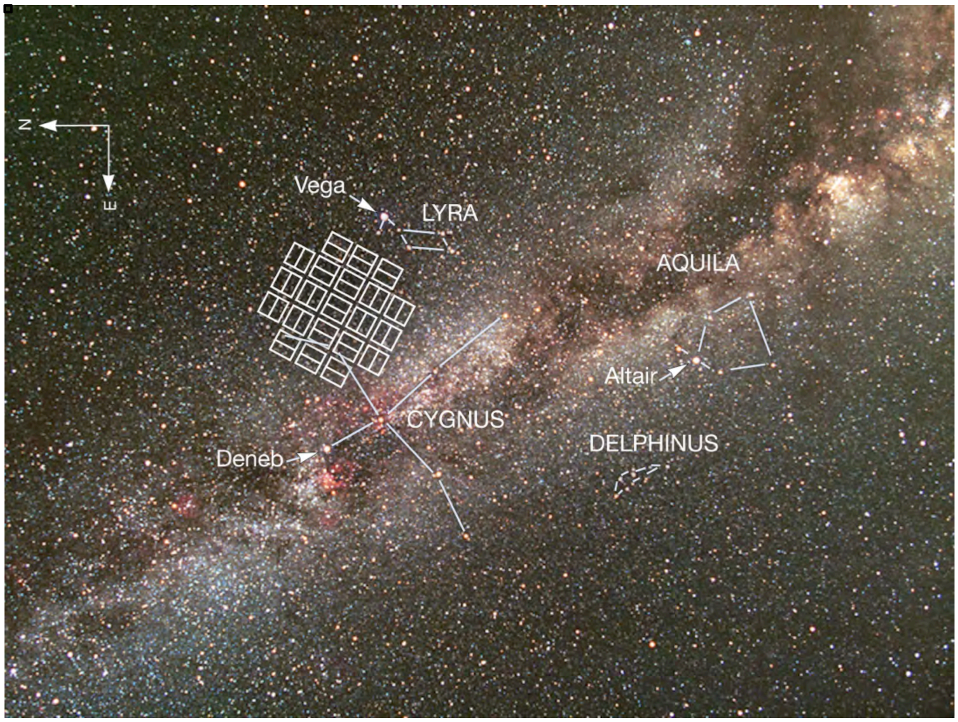
Kepler is looking for small, Earth-size planets in orbit around other stars; planets where we might expect to find life.



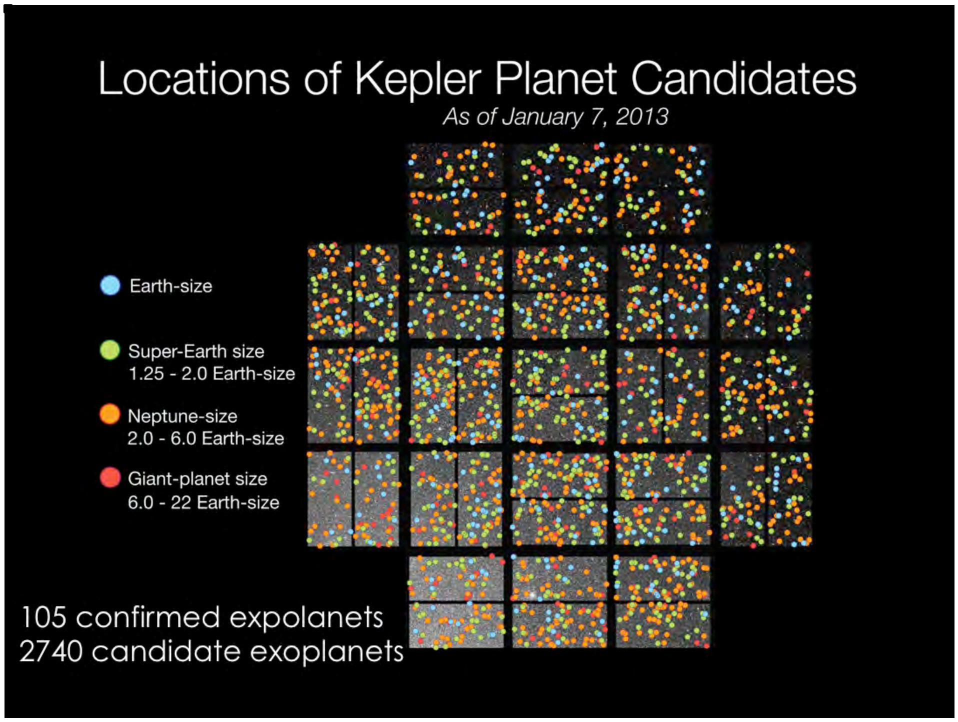
Kepler was built to find small, Earth-sized planets by waiting for a star to wink.

Some planets, orbiting some stars, will be oriented on the sky so that the planet actually passes in front of the star. We cannot see the planet, but with a good enough movie camera, we can measure the tiny decrease in the star's brightness when the dark planet is blocking some of the star's light.

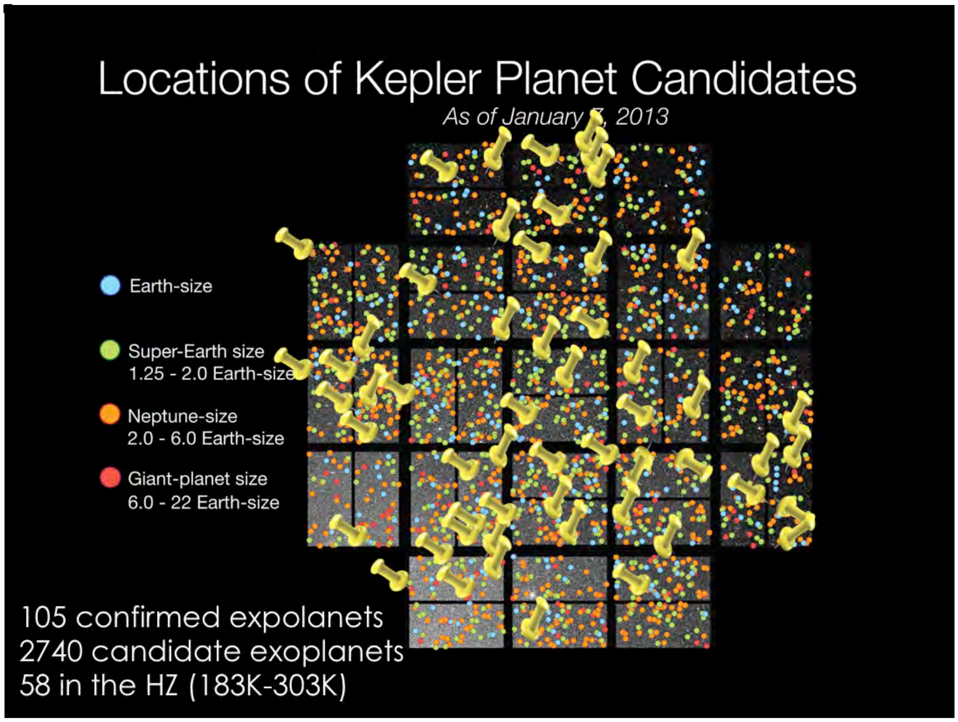
As the planet moves in its orbit and begins to pass in front of the star, the steady brightness of the star (as measured by Kepler's super-sensitive



Between the constellations of Cygnus and Lyra, Kepler is now constantly studying 100 square degrees of the sky – about the area covered by your hand at arm's length. This patch of sky is actually a little above the plane of the Milky Way so that there will be lots of stars, but not too many to confuse Kepler's cameras. Each of those 42 white boxes represents an array of CCD detectors – the same sort of detector that makes your cell phone camera work – but Kepler doesn't have just 3 mega-pixels or 10 mega-pixels, it has 95 million, 617 thousand, six hundred pixels, and it uses them to star at 150,000 stars continuously.



And it works! To date Kepler has discovered 2740 candidate exoplanets. 105 of these have been confirmed with studies by groundbased telescopes, and less than 10% of the candidates are expected to be false positives.



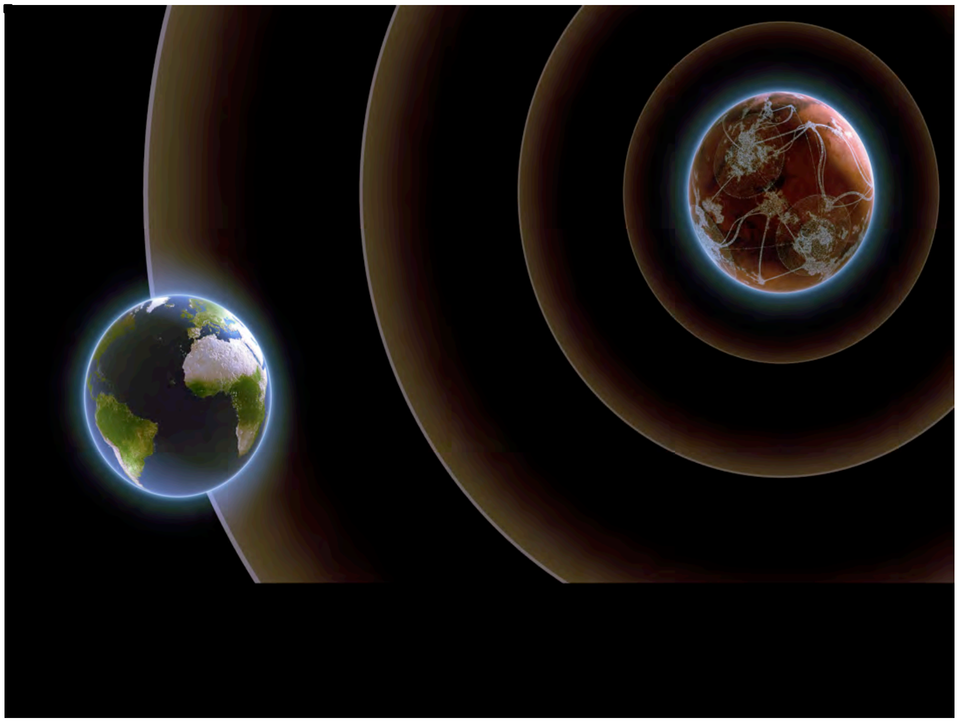
Of these exoplanets, 58 are at the right distance from their star to have a surface temperature that could support liquid water – within the so-called Habitable Zone.

Kepler, has not yet found Earth 2.0, but many of my colleagues believe it is just over the horizon.

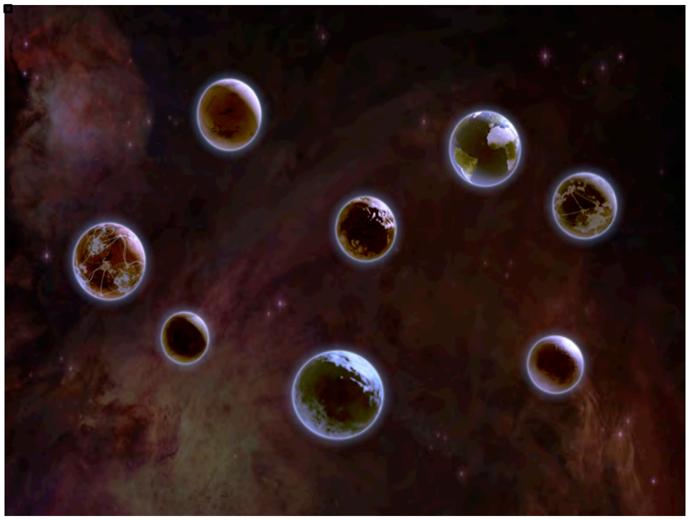
At the SETI Institute my Astrobiology colleagues try to understand what atmospheric chemical signatures would imply active biology on the surface of a distant planet.

Detection of such 'biosignatures' will require new space telescopes with new technologies that are probably a decade or more in the future.

For now SETI is the only game in town – we are counting on the deliberate actions of any intelligent inhabitants to find life beyond the Solar System



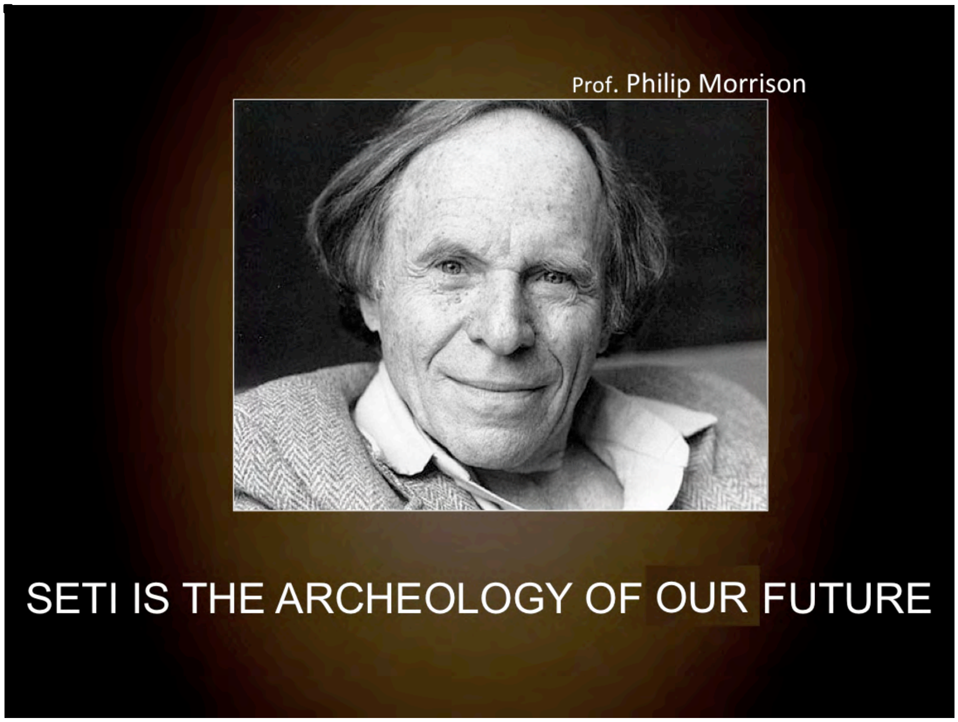
Our own technology is visible over interstellar distances, and *their* technologies may be as well. A deliberate beacon, a vast communications network, a shield against asteroid impacts, or even something entirely unforeseeable might generate signals at radio or optical wavelengths that a determined program of searching might discover. SETI could succeed tomorrow, or never.



Ultimately, success or failure in SETI will depend upon the mean distance between technologies throughout the cosmos. Distance across space and distance across time. In order for two technological civilizations to be close enough within space and time to interact, their technologies must survive for a long time - *longevity* is the key. We ourselves are a very young technology in a very old universe. We don't yet know whether it is possible for technology or technologists to persist.

The detection of a signal will tell us the answer.

Might the discovery of another, older cosmic culture inspire us to find a way to survive our increasingly uncertain technological adolescence?



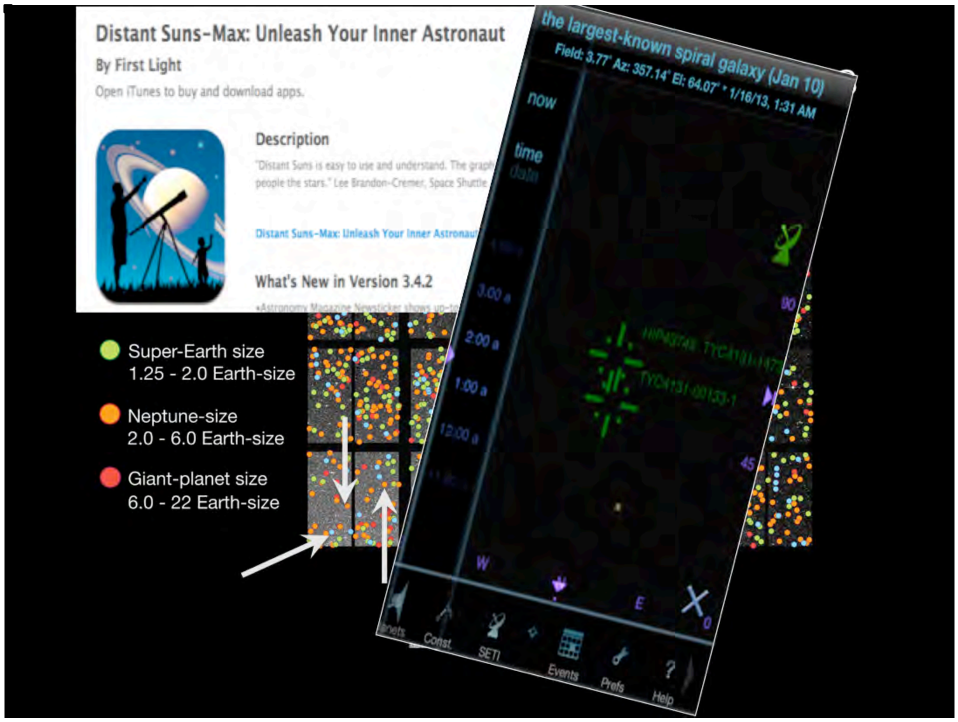
Prof. Philip Morrison expressed this idea powerfully – he said “SETI is the archeology of the future”. The tyranny of light speed means that any detected signal will tell us about THEIR PAST, but the longevity required for that detection will inform us that WE have the potential for a long FUTURE.

Although the first SETI observation was done with a radio telescope 50 years ago, we have sampled very little of the cosmic ocean.

I started this presentation by inviting you to change your perspective – think of what it would mean to detect another intelligent species!

In Northern California, the Allen Telescope Array with 42 antennas is trying to do just that.

Computing and electronic technologies are improving exponentially. With continued support, over the next two decades we can systematically explore our local corner of the universe, and we'd like every one to come along.

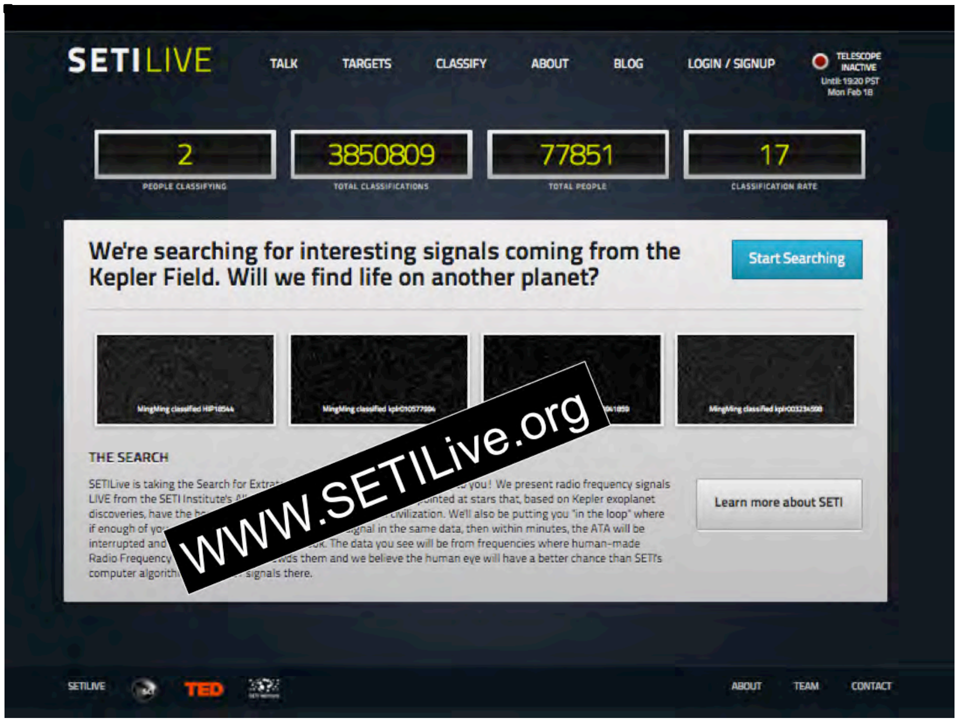


We are searching through all the exoplanets that Kepler and groundbased telescopes have discovered.

The ATA is able to do this 3 planetary systems at a time.

If you happen to have The Distant Suns App on you iPad or iPhone, you can click on the green radio telescope icon and see where we are observing.

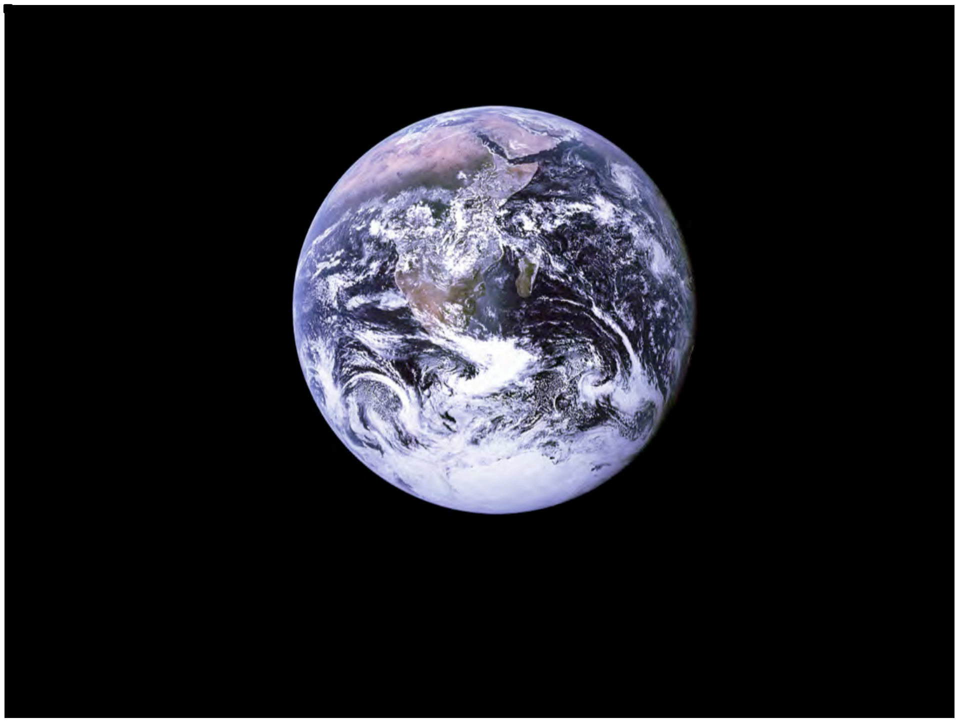
And if you'd like to become involved as a citizen scientist, you can sign up with Zooniverse



To participate in SETILive.

Volunteers can mark patterns that may be overlooked by the automated programs and help to discriminate potential ET signals from terrestrial interference in crowded frequency bands that currently confuse SonATA. Signals that are confirmed by the volunteers are sent back to the array and are followed up on immediately.

Right now this citizen science program is available only within a browser, but its ready to be developed for mobile platforms where it could engage you while you are waiting in line.



If we can get people around the world involved with this search, we have the opportunity to change their perspective too --- to have them identify themselves as Earthlings

SETI is a mirror that is capable of showing us ourselves from an extraordinary new perspective. A mirror that can trivialize the differences among us. If the pursuit of evidence of intelligent life beyond Earth does nothing else but reveal this perspective to every human being, it will be still be among the most precious and profound endeavors in all of history.

Calibrating our place in the cosmos may well be within our grasp in the 21st century – I've enjoyed sharing my perspective with you today and hope you will join us and support our scientific exploration.