

SOUNDS OF THE UNIVERSE

RISING ABOVE THE NOISE

A.D.

THE EARTH IS THE CENTER OF THE UNIVERSE

THE UNIVERSE IS PERFECT AND STABLE

1500

THE EARTH AND PLANETS ROTATE AROUND THE SUN

THE UNIVERSE IS NOT STABLE AND CHANGES

1600

THE SUN IS THE CENTER OF OUR SOLAR SYSTEM

GALILEO AMONG FIRST TO USE OPTICAL TELESCOPE TO EXPLORE THE STARS

GRAVITY DETERMINES THE MOTION OF THE PLANETS

1700

OUR SOLAR SYSTEM IS PART OF THE MILKY WAY

1800

WE ARE ALL MADE OF THE SAME ELEMENTS

NIKOLA TESLA SUGGESTS RADIO TECHNOLOGY COULD BE USED TO CONTACT OR DETECT ALIEN LIFE

1900

RADIO ASTRONOMY BORN WHEN KARL JANSKY DISCOVERS RADIO WAVES COMING FROM THE MILKY WAY

RADIO ASTRONOMY TAKES A LEAP FORWARD WITH THE DISCOVERY OF LINKING TELESCOPES IN AN ARRAY

2000

NUMEROUS EXOPLANETS ARE BEING FOUND

DISCOVERIES ARE DONE AT A FASTER RATE THAN EVER

THE FUTURE

"THE CONSTRUCTION OF THIS INSTRUMENT IS AKIN TO LAYING THE KEEL OF THE SANTA MARIA. COLUMBUS'S SHIP CHANGED THE WORLD; THIS ARRAY MAY DO THE SAME."

Seth Shostak

Human technology is quite noisy. Humans have been sending out very loud signals into space for decades. So to detect and understand the radio signals we receive from space, we have to "hear" it over those of our own making first. It is like trying to hear a pin drop on the other side of the world when you are standing in front of a 10-foot blaring speaker at a concert.

That is why the area all around you, surrounded by the beautiful mountains of the Hat Creek Valley, is an ideal location not only for stargazing on a clear night but for radio astronomy as well. The valley walls and mountains form a natural shield against radio interference from surrounding cities. The spot you are standing on was chosen, after many surveys by early astronomers, as a quiet place to tune in and dissect the weak, naturally occurring radio waves Earth receives from all around us. These are all clues to the nature of the universe.

As the field of radio astronomy developed, and humans realized for the first time that our radio transmissions could be detected from space, a thrilling and history-changing question arose from scientists.

What if we are not the only life form in our galaxy emitting evidence of technology?

LISTENING FOR ET

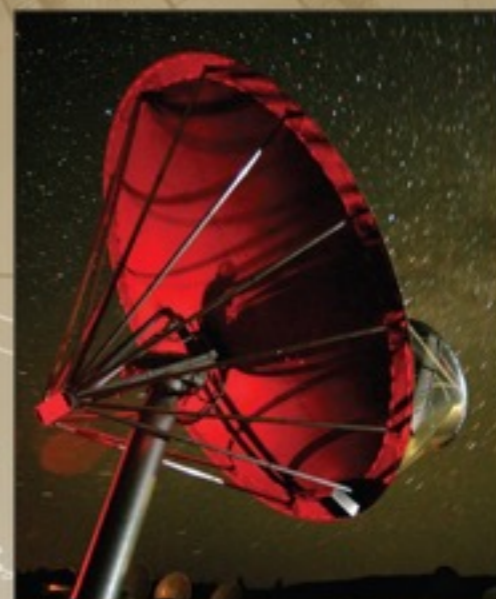


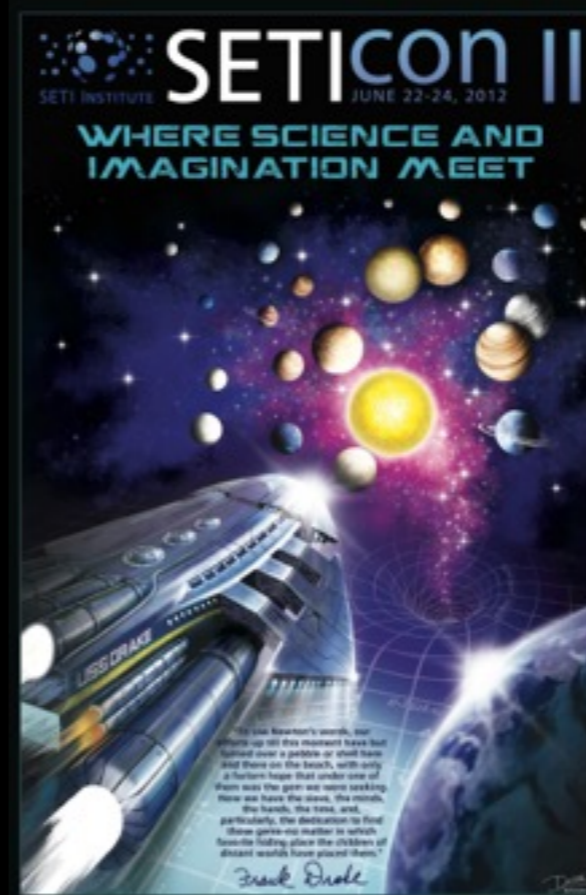
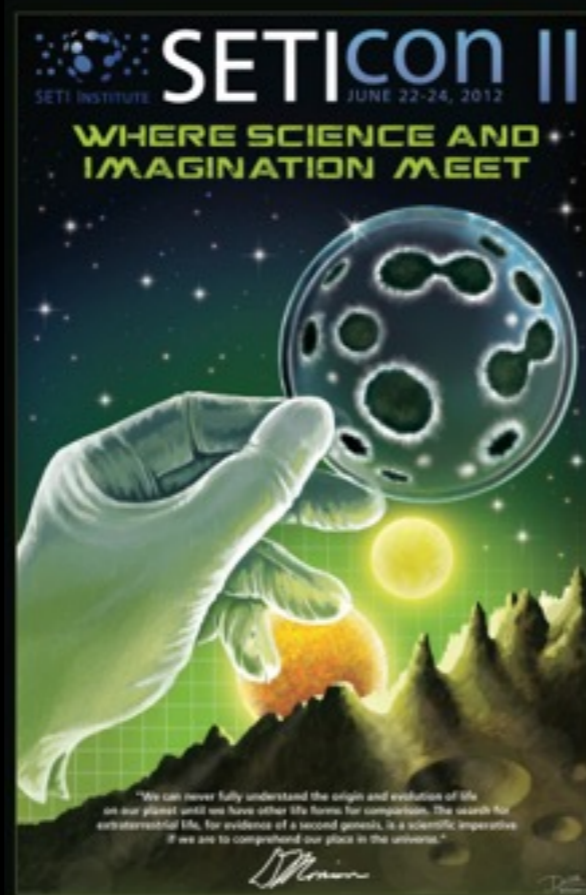
If underneath all the naturally occurring radio emissions from the cosmos, we detect an "artificial" or engineered radio signal not coming from us, it could change everything! Detecting a signal from a distant technology would confirm that we are not alone in the universe and another civilization is out there. It would be the most profound discovery in human history.

In pursuit of this amazing possibility, a new scientific discipline (SETI, search for extraterrestrial intelligence) began in 1959, dedicated to detecting evidence of technology beyond Earth.

The Allen Telescope Array (ATA), designed and built by the SETI Institute and UC Berkeley, was commissioned in 2007 for a wide range of scientific goals. It is the only array of its kind in the world using the tools of radio astronomy for SETI research 24 hours a day, 365 days a year.

As long as the SETI Institute can continue to search and listen, the research happening here could change the course of human history at any moment, on any day. Even right now.





SETICon II

'Artists Imaging Exoworlds-Getting It Right'

SETI INSTITUTE SETICon II JUNE 22-24, 2012
WHERE SCIENCE AND IMAGINATION MEET

LOCATION:
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SANTA CLARA, CA 95054

DATE:
JUNE 22-24, 2012

INFO:
WWW.SETICON.ORG

Minerva and its two moons



Kepler-62



Kepler-62e & Kepler-62f are relatively close to each other and both are sustaining water and rocky surface as suggested by the clouds' color, water, atmosphere and rocks

Asteroid 87 Sylvia



Planetary Lake Lander

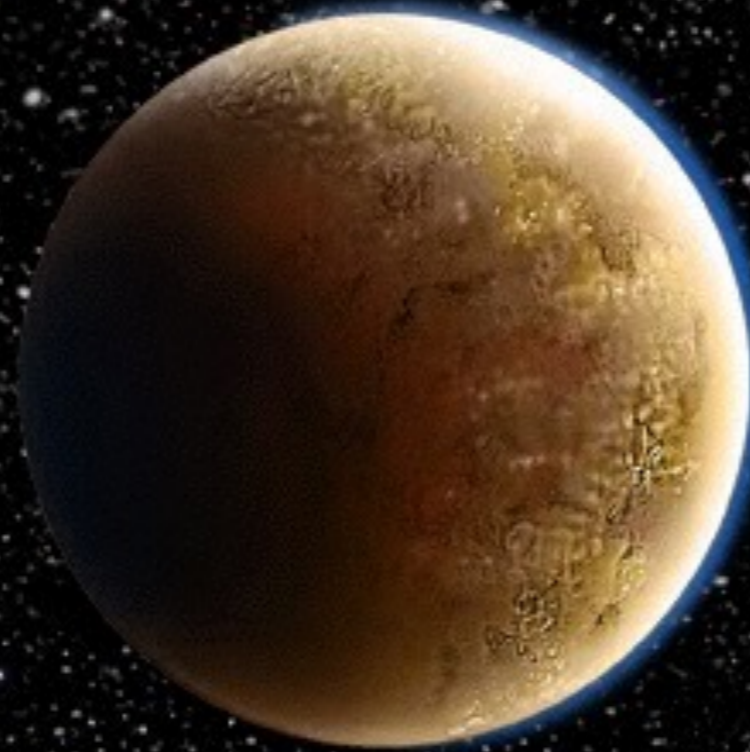


Kepler 186f



If you were standing on the surface of this planet, the star would appear about 30% larger in the sky due to the proximity of the planet in the habitable zone to its star. M dwarfs emit much less visible radiation than our Sun, instead their flux peaks in the near-infrared, so plants might appear dark yellow or even black to absorb as much of the visible light as possible.

Kepler 186 — Ice - Iron - Rock



Gigantipede



...lives on **Kepler-62f** which is a bit bigger than Earth, with higher gravity, cold, may have a lot of ice. The antenna are used mostly in social interactions with other gigantipedes. The big eyes allow it to see clearly in darker places under shrubs where it must go to dig up roots which are its main diet. Opposable thumb on the front pair of appendages indicate that it may be able to handle tools.

Deep Dweller Octopod



...lives on **Kepler-22b** which is large, has high gravity, and is hot, possibly an ocean planet. This enormous sea creature has extra eyes on top of his head to look above where most of his prey is. There are also a few eyes to look in front. The prey is mostly whales and sharks, which are an indication of just how large the deep dweller octopod actually is. His teeth are sharp to chew down the fish and he has serrated claws to also grip/tear his food with.

Gliding Hopperoo



...lives on a **moon of Kepler-90h** which is a bit smaller than Earth, with low gravity, and quite hot. Low gravity make relatively thin legs reasonable, but they are powerful enough to take high jumps and glide through air to a new place. The wings are rich in blood vessels that help cool it when gliding, especially through the shade of tall forest trees. It has a double set of eyes so it can look to the ground, up, and all around at the same time. Opposable thumb on the appendages indicate that it may be able to handle tools.

ASTRON - Cognitive computing to process large astronomical surveys



Drake Equation

THE **NUMBER** OF CIVILIZATIONS IN OUR GALAXY WITH WHICH COMMUNICATION IS POSSIBLE

$$N =$$


$$i E d \Omega_i d \Omega_j k^2 \frac{d \sigma(\theta, E)}{\rho}$$
$$\int_{\Omega} D(t_1, x) \frac{\varphi(t_1, \Delta t, x)}{(-\Delta t)}$$
$$\lim_{t \rightarrow 0^+} \int_0^T \int_{\Omega} D(t_1, x) \frac{\varphi(t_1, \Delta t, x)}{(-\Delta t)}$$
$$\int_0^T \int_{\Omega} D(t_1, x) \frac{\partial \varphi}{\partial t_1}(t_1, x) dt_1 dx$$

THE AVERAGE **RATE** OF STAR FORMATION PER YEAR IN OUR GALAXY

$$R_*$$


THE FRACTION OF THOSE STARS WITH **PLANETS**

$$f_p$$


THE AVERAGE NUMBER OF THOSE PLANETS THAT MAY DEVELOP AN **ECOSYSTEM**

$$N_e$$


THE FRACTION OF THOSE PLANETS THAT SUCCEED IN DEVELOPING **LIFE**

$$f_l$$


THE FRACTION OF THOSE PLANETS WITH LIFE THAT DEVELOP **INTELLIGENT LIFE**

$$f_i$$


THE FRACTION OF THOSE PLANETS WITH INTELLIGENT LIFE THAT DEVELOP **INTERSTELLAR COMMUNICATION**

$$f_c$$


THE AVERAGE **LENGTH** OF TIME SUCH CIVILIZATIONS SURVIVE AND CONTINUE TO SEND COMMUNICATIONS

$$L$$


SETI INSTITUTE

ASTRON - APERTIF receiver



ASTRON

Netherlands Institute for Radio Astronomy

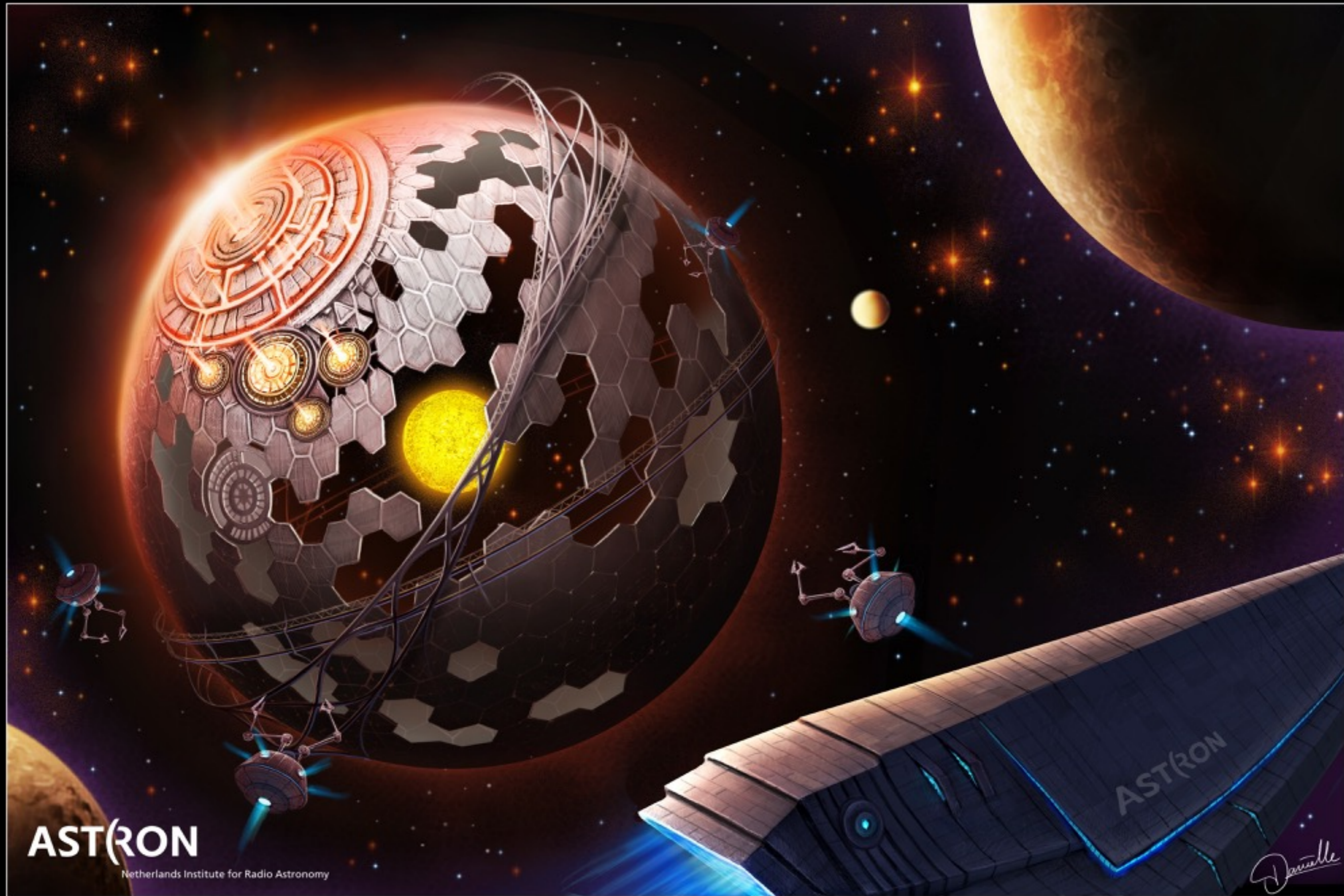
J. van der Meer

Kepler 138b



The artistic concept shows the planetary system harboring Kepler-138b, the first exoplanet smaller than Earth with both a mass and size measurement. The sizes of the planets relative to the star have been exaggerated. Author Daniel Jontof-Hutter worked with the artist to represent “ghost images” of each of the planets that depict the locations where the planets would have been had they not been affected by the gravity of the other planets causing them to accelerate or slow down in their orbit. The accelerating and slowing of the planets gives rise to variations in the timing of the transits, or transit timing variations (TTVs). This is an artistic rendering of the effect of TTVs that was used to determine the masses of the planets. TTV analysis was first used to discover planets that were not actually transiting, but were affected by nearby planets that were transiting (see News item about Kepler-9)

ASTRON - Mike Garrett Paper Kardashev type III civilisations



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ASTRON - Mike Garrett Paper Kardashev type III civilisations



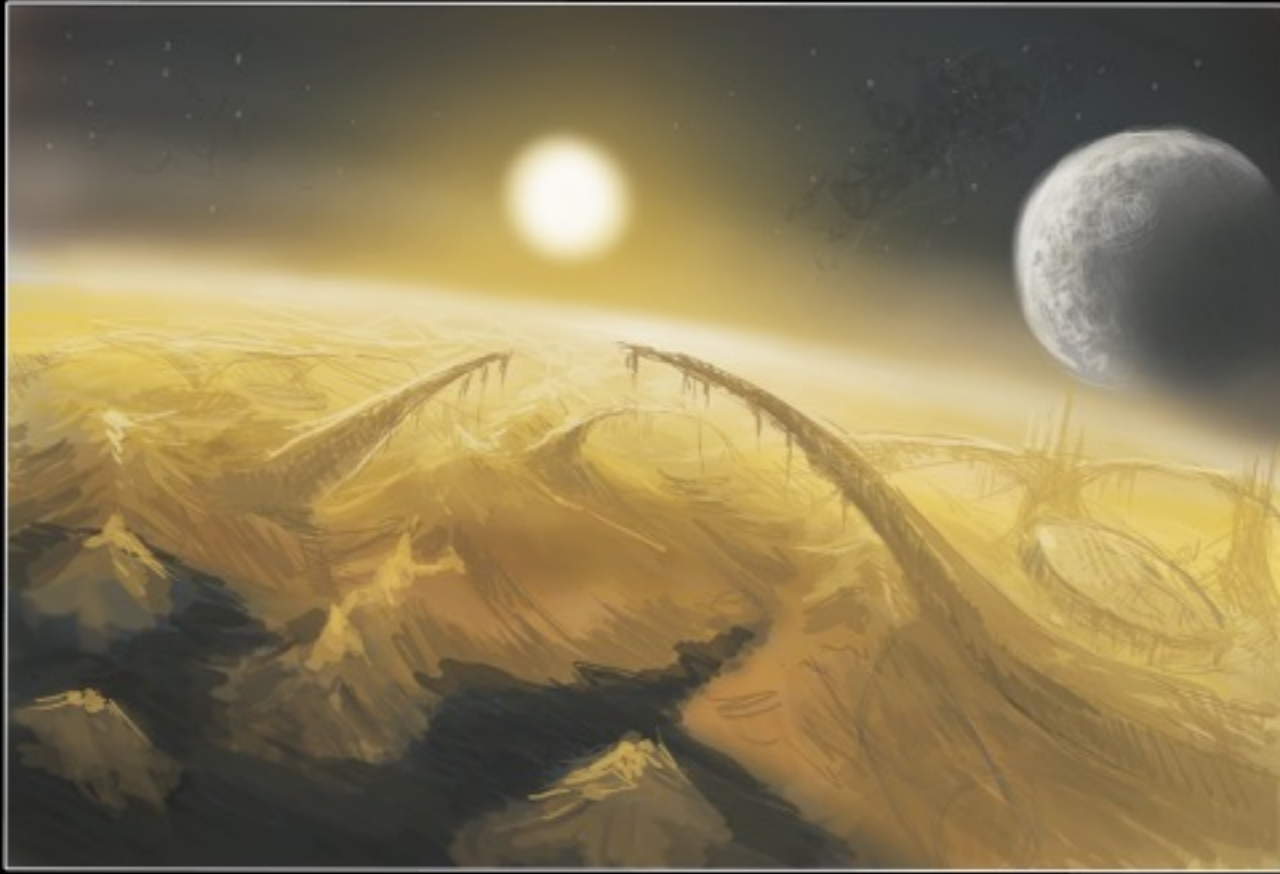
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Kepler 452b Sketches



Kepler 452b Surface

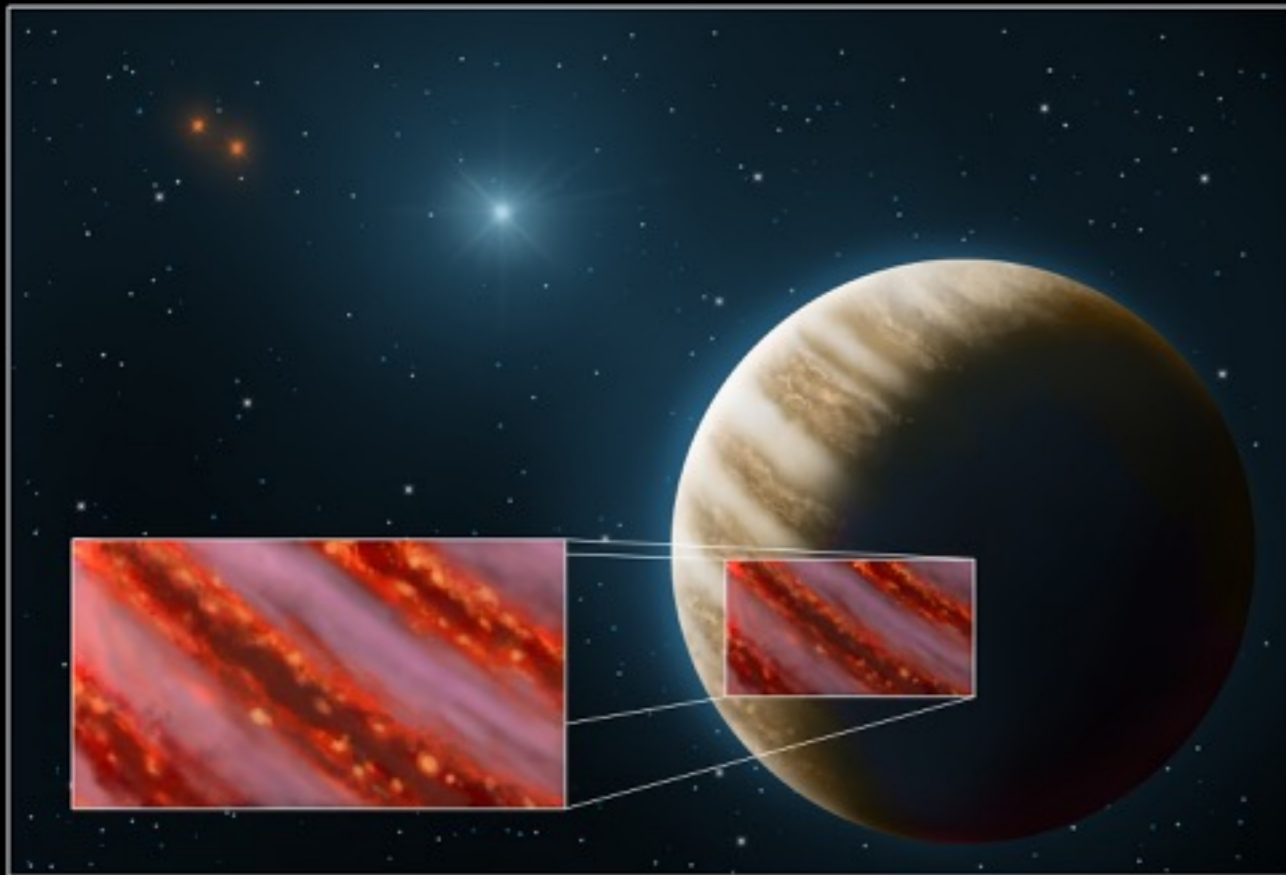
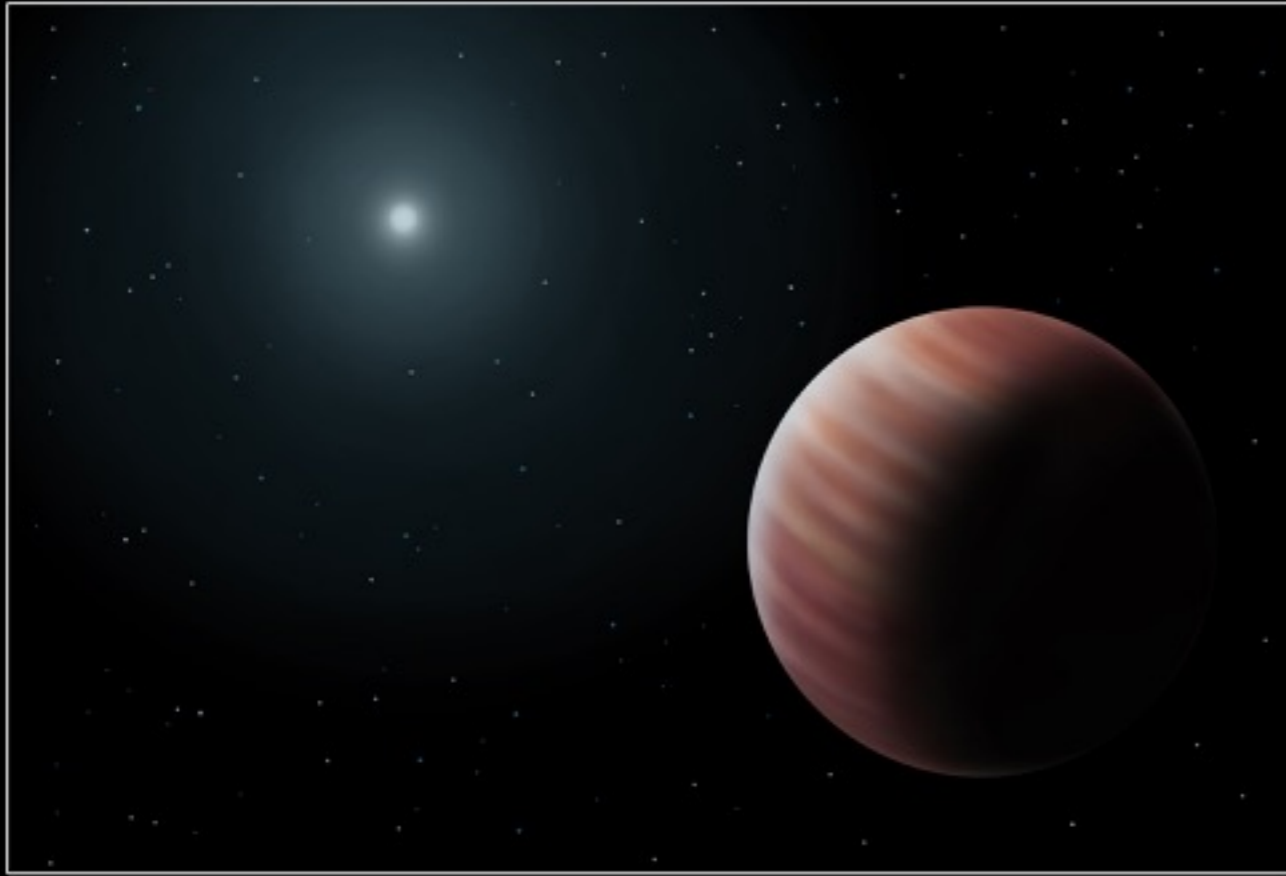


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ANCIENT RUINS
on
Kepler-452b!



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AMIDST SMOKING VOLCANOES!

Hot Jupiter 51 Eridani b - Gemini Planet Imager - Sketches



Hot Jupiter 51 Eridani b - Gemini Planet Imager

An artistic rendering of the Jupiter-like exoplanet, 51 Eri b, seen in the near-infrared light that shows the hot layers deep in its atmosphere glowing through clouds. Because of its young age, this young cousin of our own Jupiter is still hot and carries information about the way it was formed 20 million years ago.



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SPACE

Hello To Earth 2.0! Historic Kepler Discovery We Are Not Alone



Measuring the mass of a small exoplanet
A rare measurement of the mass of a small exoplanet is reported in Nature.

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- ▶ Reassuring' data show slowd outbreak

Danielle Futselaar, SETI Institute

NATIONAL GEOGRAPHIC

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SEARCH

LIVELY OCEAN

THE POLAR THERMOCLINE

THE GREAT ESCAPE

Earth's Closest Cousin D Among New Pile of Plane

Called Kepler 452b, the world is a bit bigger than Earth and could have



Kepler 452b, the most Earthlike exoplanet found so far, could have a rock atmosphere.
ILLUSTRATION BY SETI INSTITUTE/DANIELLE FUTSELAAR
By Nadia Drake, National Geographic
PUBLISHED JULY 23, 2015

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Earth-sized exoplanet found orbiting Sun-like star

Potentially rocky world spotted by Kepler spacecraft offers glimpse at Earth's future.
Astronomers have spotted the closest thing yet to an "Earth twin" — a small planet orbiting a Sun-like star.



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- ▶ Table of contents
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Exoplanets

SA Scientists Help Understand Newly Discovered Planet

Image of the Day

Hubble Sees a "Mess of Stars"

LUCY & STEPHEN HAWKING

DE GROTE AVONTUREN VAN



GEORGE

IN HET ONEINDIGE HEELAL

ILLUSTRATIE: DANIELLE FUTSELAAR

Astroblogs magazine

10 jaar Astroblogs • nummer 1 • losse verkoop 9,95



Wat is de meest verschrikkelijke theorie voor de mensheid?

Is Mercurius het overblijfsel van een potje planetenbiljart?

De bouw van een klassieke 40 cm truss Dobson

COGITO stuurt met Dwingeloo radiotelescoop hersengolven naar Titan

ontdekt nieuw on...
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28 SEPTEMBER 2015 DOOR JA...
...Grote Mark...
...laatste oranje rode zon...
...heeft weten te vinden
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...TAYLOR • 10 REACTIES
...was captured by Amer...
...the comet reached the...
...ESA Rosetta/OSIRIS for OSIRIS...
...DASPIIDA
...Very slow after that r...
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...Een ver...
...gen van
...en 17 tot en met wipog 23 oktober
...ly leven. De mensheid
...en 17 tot en met wipog 23 oktober

The hypothesis of an alien megastructure around KIC 8462852 is rapidly crumbling apart





*Repeating
FRB's at
Arecibo*





Danielle



