Abstract: Since the discovery of the first exoplanets in the early 1990s, we have detected more than 4,000 worlds beyond our solar system. Many of these are similar in size to our Earth, leading to an obvious question: could any be habitable?

For now, we typically only know the size and orbit of these planets, but nothing about their surface conditions. Although we cannot know for sure if these worlds could support life, we can use models to speculate on what we might find there.

In her Nov. 6 talk at Perimeter Institute, astrophysicist and author Elizabeth Tasker will take audiences for a speculative stroll through a few of the alien worlds weâ€™ve discovered in the galaxy, and ponder whether someone else may already call them home.

Elizabeth Tasker is an astrophysicist at the Japan Aerospace Exploration Agency (JAXA). Her research explores the formation of stars and planets using computer simulations. She is particularly interested in how diverse planets might be and what different conditions might exist beyond our Solar System. Elizabeth is also a keen science communicator and writer for the NASA NExSS â€œMany Worldsâ€• online column. Her popular science book, The Planet Factory, was published in Canada last April.
Home away from home
The hunt for habitable planets

Elizabeth Tasker @girlandkat
Planet minimum mass

???
51 Pegasi b

First exoplanet discovered around a sun-like star
First exoplanet discovered around a sun-like star

51 Pegasi b
Orbit 4 days

Nobel Prize in Physics 2019
Michel Mayor & Didier Queloz
Transit
~75%

Radial velocity
~20%
Voyage to the Prehistoric Planet (1965)

Venera 4 (launch 1967)
water ready!
Venera 14 (1982)

460°C
90 atmospheres
Perfect temperature?
REALITY CHECK

A zone in which planets are habitable?
'We've found dozens of potentially habitable planets - now we need to study them in detail'

measured

size, orbit

hoping
wear the right coat
If there is another Earth out there...

...we’ll find it in the habitable zone
Another name?
(river god idea: Chris Lintott)

ECHaLWOTS zone?
(coined by Jessie Christiansen)

Earth Could Have Liquid Water On The Surface
Hubble Space Telescope
Launch: 1990 (!)
K2 18b

Hubble Space Telescope
Launch: 1990 (!)
8 x Earth mass

2.3 x Earth size

density
3.3 g/cm³
3.3g/cm³
H, He ~ 0.7% mass

Surface: Pressure > 20 x bottom of Mariana Trench

3.3g/cm$^3$

H, He $\sim$ 0.7% mass

Surface: Pressure $> 20 \times$ bottom of Mariana Trench

Temperature 1000s°C

K2 18b

3.3 g/cm³
water ~ 50% mass

water < 0.1% mass
Little ice age (~1600s): 1 - 2 °C

Frozen Thames, 1677 (Abraham Hondius)
Life might hibernate during inhospitable spells
(Kane et al. 2012)

The Force awakens
.... in 6 months
HOW TO...

...die horrifyingly inside the habitable zone
How different can Earth-like be?

http://earthlike.world

@earthlikeworld
EARTH-LIKE

Hey @EarthLikeWorld, I’d like a planet with a land fraction of 0.6 and volcanism rate of 2.5 with a habitable zone position of 0.86!

How different can Earth-like be?

http://earthlike.world

@earthlikeworld
MANY WORLDS
NASA NExSS column for in-depth exoplanet & astrobiology stories

http://www.manyworlds.space
@nexssmanyworlds
nexssmanyworlds
THE CENTER OF THE UNIVERSE

What if your mother just disappeared?

Elizabeth is also a real person.
SHAMELESS PITCH!

utterly

Shiny book, full of truly awful planets

Hot Jupiters, Tatooine worlds with 2 stars, rogue worlds with no star, planets with seas of lava or tar …

Death awaits…

@girlandkat