Solar System happenings

Richard J Edgar, Learners lecture for Oct 28, 2020

Website for course materials:
richardjedgar.github.io

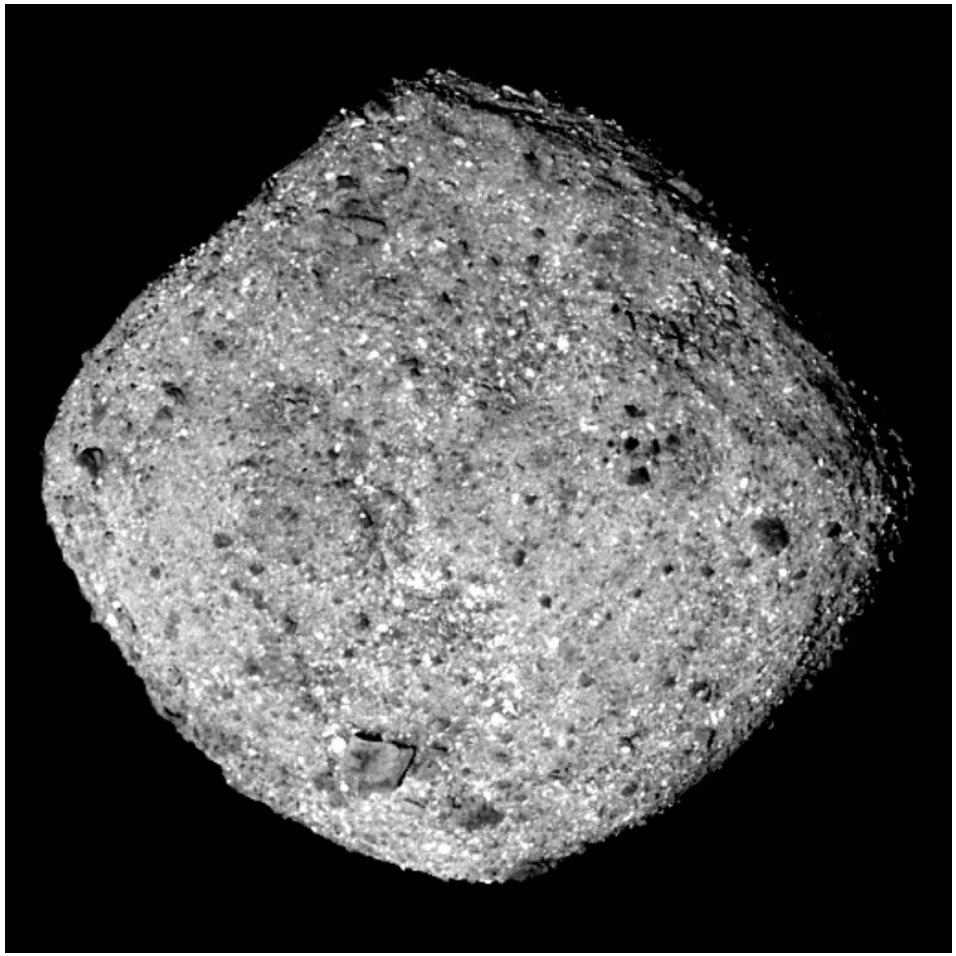
- Asteroids:
  - Recent sample obtained from Bennu; see also Ryugu
  - 2018 VP1 and potentially hazardous objects
- Potential life in the clouds of Venus??
- Updates on Mars exploration

Touch and Go

Sampling asteroid 101955 Bennu

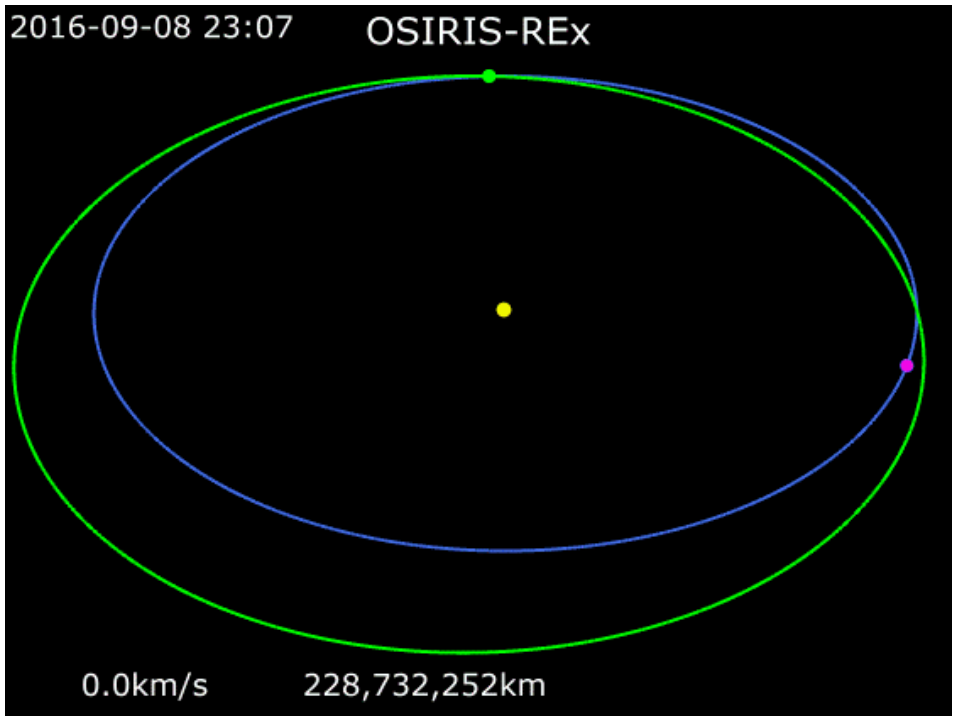
The OSIRIS-Rex Mission

- OSIRIS-REx stands for “Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer”
- Launched Sep 8, 2016
- Arrived at asteroid Bennu Dec 31 2018
- Sample obtained last week
- Will return the sample on or about Sep 24, 2023



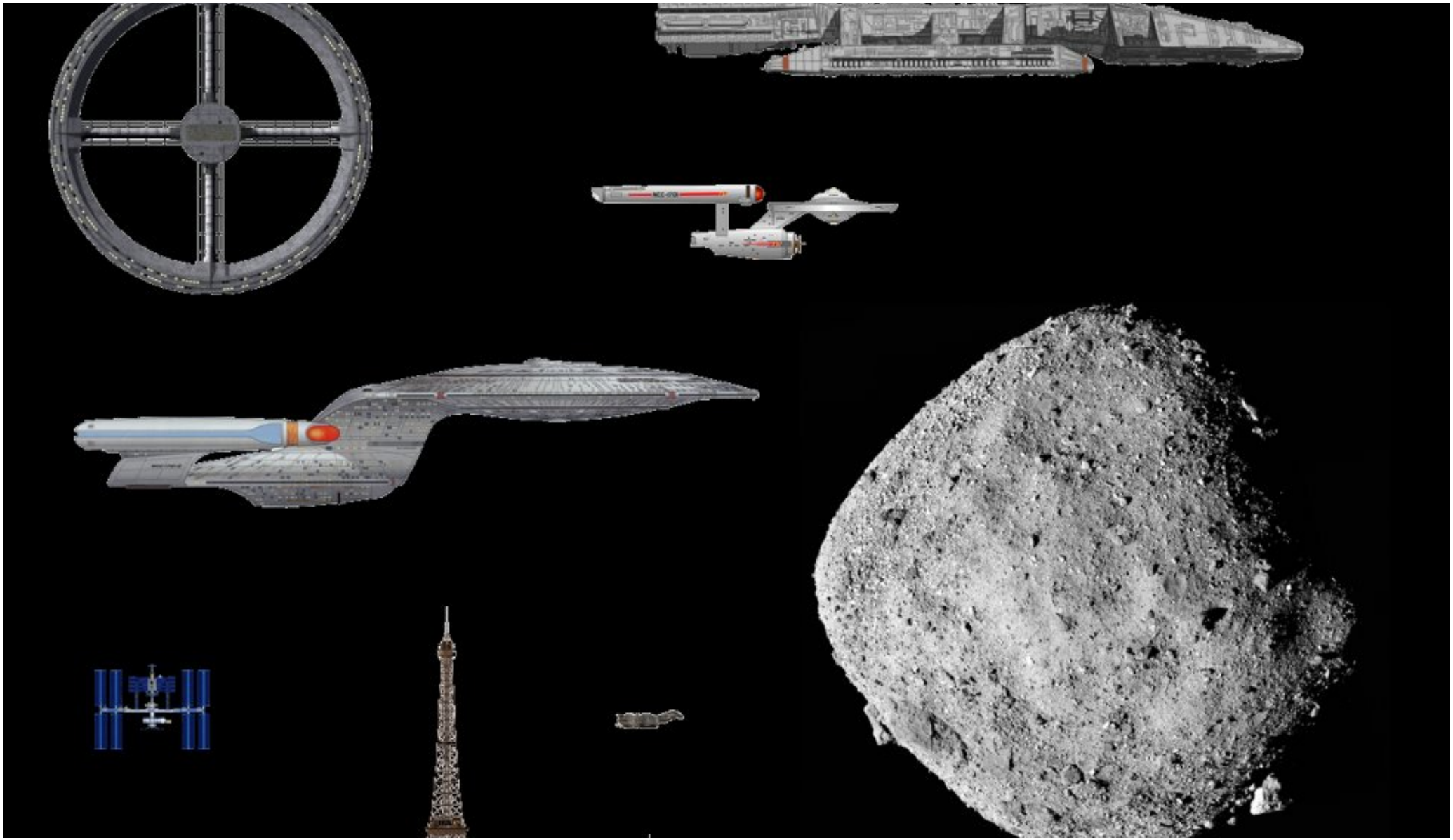
Orbits

- The orbit of Bennu crosses that of the earth. It's unlikely to hit the earth anytime soon. 1 in 1800 chance before 2170.
- Blue=earth, green=Bennu, pink=OSIRIS-REx
- It's worth knowing what such asteroids are like, in case we need to divert one.



Objectives

- Sample of pristine, ancient solar system material for analysis on earth.
- What are near-earth asteroids like? Solid hunk of rock, or pile of rubble?
  - The answer to this question drives strategies for diverting an asteroid if that becomes necessary.
- Measure non-gravitational forces on the asteroid (Yarkovsky effect) to make orbit prediction more precise.
- An article on the sample collection: https://spaceflightnow.com/2020/10/23/osiris-rex-overflowing-with-asteroid-samples-after-bagging-a-bounty-from-bennu/



Japanese Hyabusa2 Mission

- Very similar idea, destination 162173 Ryugu
- 2014 Dec 3: Launch
- 2018 Jun 27: Arrived at Ryugu
- 2019 Nov: departed for home
- 2020 Dec 6: Arrival at earth.
- Ryugu may be another piece of the same rock that spawned Bennu

Oh great, Neil…

- Be careful what you read (including the fine print)
- Wait a day or two for somebody else to react
- Don’t panic
- Think about the source (publication and the person quoted)

Will an astroid hit the earth?

- It happened 65 million years ago, wiping out the dinosaurs.
- A small one burned in the atmosphere over Chelyabinsk, Russia Feb 15, 2013
- There's a new one, 2018 VP1 buzzing the earth on Nov 2, 2020.
- Yes, that's the day before the election.
- You can buy yard signs for your favorite outcome…
- But no, it's not going to hit the earth. Even if it did it would burn up in the atmosphere. It's roughly refrigerator sized.
- More info: https://www.syfy.com/syfywire/no-an-asteroid-is-not-likely-to-hit-earth-the-day-before-the-election

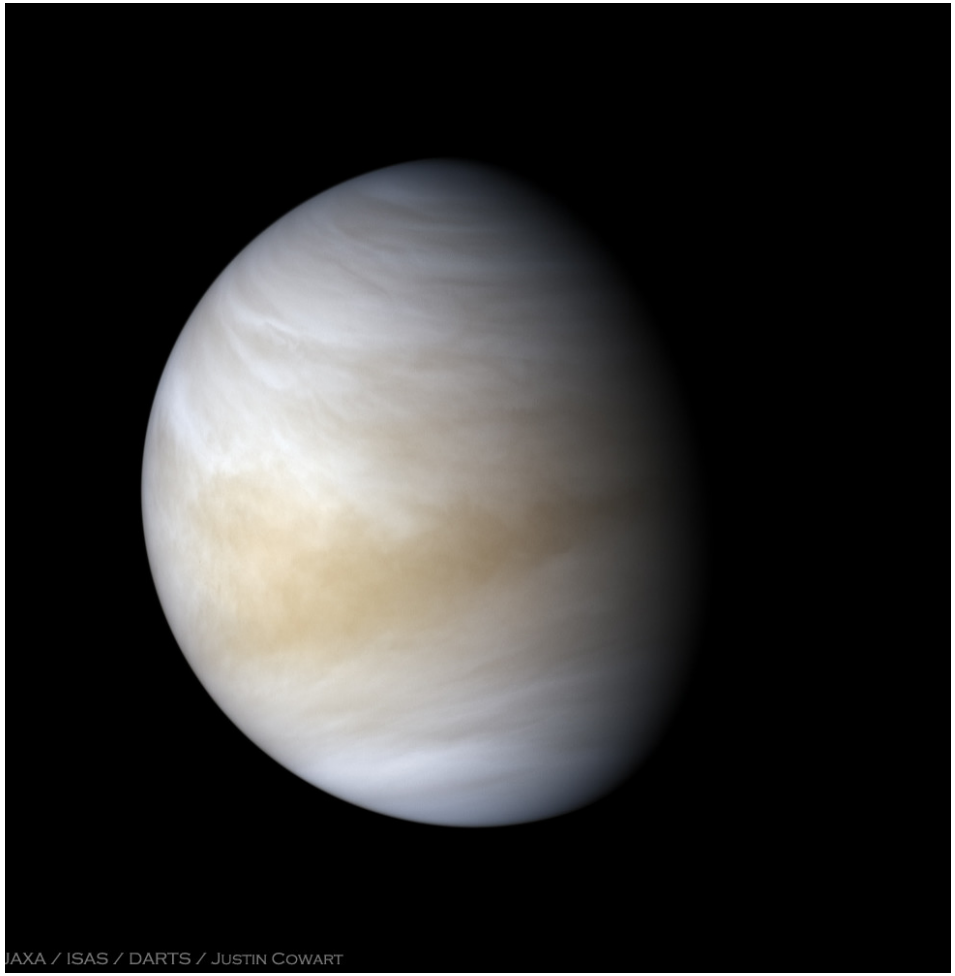

GIANT
METEOR
★20 20★
JUST END IT ALREADY


WATCH
FOR
FALLING
ROCKS

And now for something completely different…

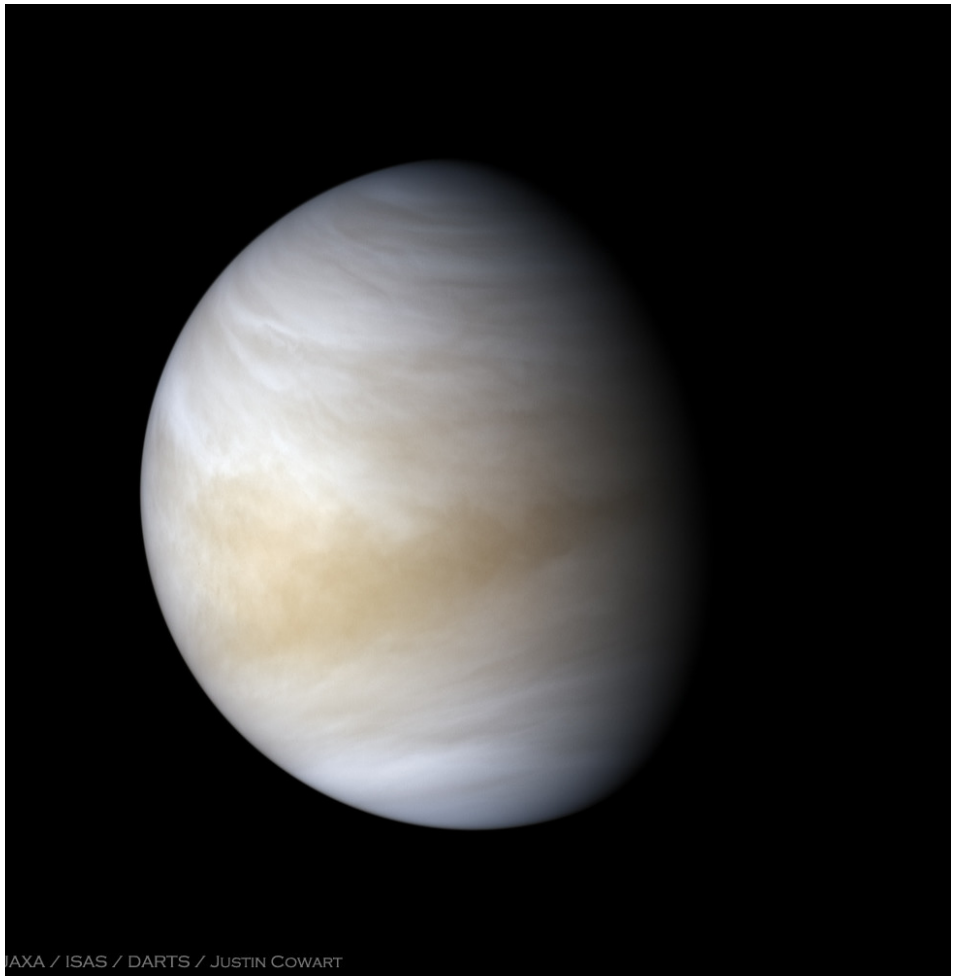
Life on Venus?

probably not…



Venus facts & figures

- Venus is our “sister” planet
- Mass very similar to earth
- Atmosphere is 90 times more than earth, mostly CO_2 with sulfuric acid clouds
- Surface temp 900ºF
- Like earth if you boiled the oceans.
- Top of cloud deck has earth-like conditions



- Astrochemistry models chemical reaction networks that might happen elsewhere in the universe.
- There's an ongoing theoretical search for "biomarkers"… chemical signatures of life in the atmosphere of the planet it lives on.
- One promising candidate is Phosphine, PH_3. On earth it's made either industrially or by anaerobic bacteria (that live where there's no oxygen). Tiny amounts come from volcanoes.
- Jane Greaves (Cambridge UK) and her colleagues observed Venus at wavelengths absorbed by Phosphine and found a signal, confirmed with both JCMT and ALMA (two millimeter-wave radio observatories).
- They calculate volcanoes or sunlight could make 1/10,000 of what they see… what else could it be?

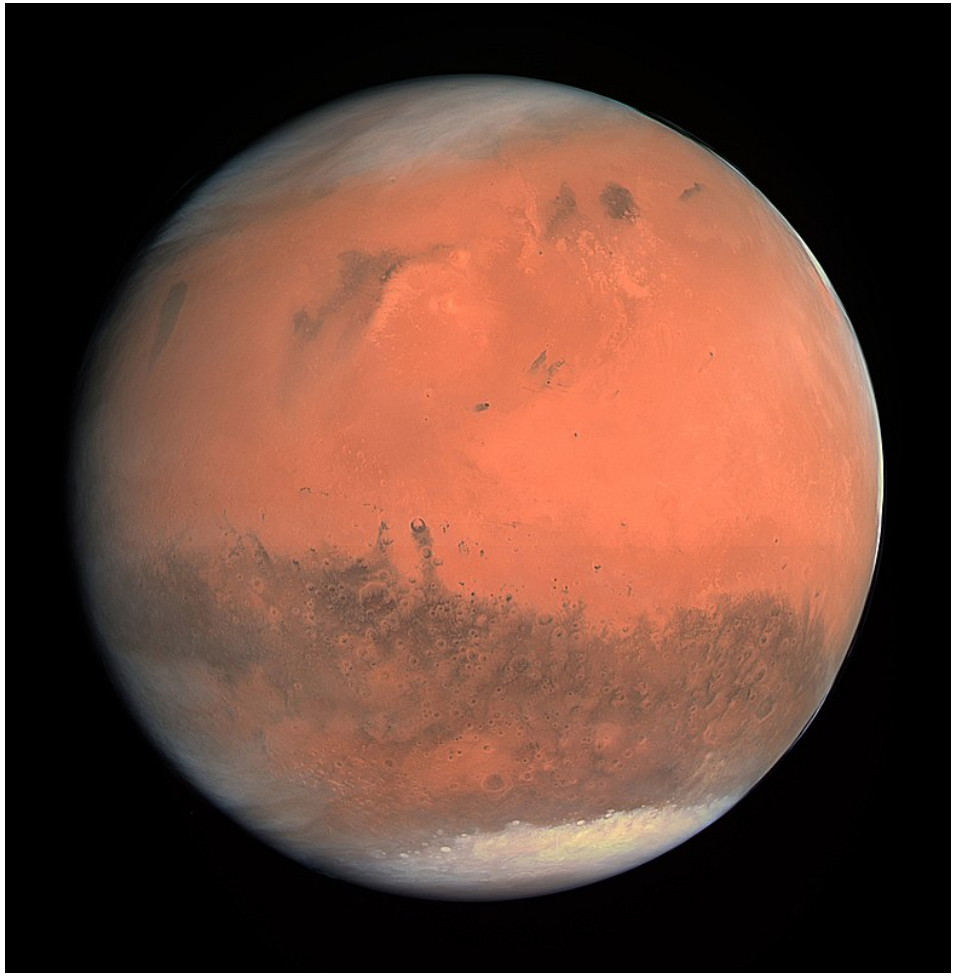
- The idea isn’t completely nuts.
- There are bacteria found high in the earth’s atmosphere (they often nucleate snowflakes, for example).
- Conditions at the cloud tops on Venus are rather similar to earth (temperature, pressure).
- It’s possible Venus had oceans early in its history, which boiled away due to a runaway greenhouse effect (this is Carl Sagan’s PhD thesis work).
- If so, and if life started on Venus when it was starting on earth, it’s possible microbes found a way to survive in the thickening atmosphere.

However, comma…

- Venus does have volcanoes; we don't know how many.
- Those "What else could it be?" arguments depend on knowing all the possibilities (I've gotten burned personally by this).
- The paper was a call for ideas and further research more than it was a claim to have found life.
- I'd call it interesting, intriguing, but not definitive.
- Again, the Bad Astronomy blog has more info: https://www.syfy.com/syfywire/so-astronomers-may-have-found-evidence-of-life-on-venus
- And from NatGeo: https://www.nationalgeographic.com/science/2020/09/possible-sign-of-life-found-on-venus-phosphine-gas/

Mars

An update on the Mars exploration program



- There's a planet in our solar system inhabited entirely by robots… Mars.
- It's more earth-like in many ways than other planets: rocky; 10% of earth mass; 0.4 earth gravity; 0.1% of earth atmospheric pressure, mostly CO2; cold (-226 to +95 F with an average of a balmy -82 F)
- It's likely that in its first billion years there was much more atmosphere, liquid water on the surface, at a time when life was getting started on earth.
- Again, if life started there, microbes might have found a way to survive in the soil or under the polar caps (liquid water has been detected under the south polar cap).

- Every two years or so there's an opportunity to send spacecraft to Mars
- Three missions are bound for Mars now; launched this Aug for arrival in Feb 2021.
- US: Mars 2020, aka Perseverance, a rover with a little helicopter scout. Will collect samples for another mission to return to earth.
- China: Tianwen-1: Lander & rover. Much like their moon rovers.
- UAE: Hope orbiter (Al Amal). Built in the UAE with help from CU, Berkeley, Arizona.
- And of course the rover Curiosity continues its mission, as do half a dozen orbiting craft (US, ESA, Russia), and the Insight lander.