STARLIGHT

Sun and starlight can pass through the atmospheres of planets before reaching us. The atmosphere absorbs some of the light. **Astronomers** and **atmospheric scientists** use this to figure out what chemicals are in the atmospheres of exoplanets and planets nearer home, like Venus.

Astrobiologists look for biosignatures in these results: certain molecules in planetary atmospheres are difficult to explain without life being present on the planet.

https://jwst.nasa.gov/content/science/origins.html

https://www.nasa.gov/feature/goddard/2019/astronomers-propose-a-novel-method-of-finding-atmospheres-on-rocky-worlds

https://www.jpl.nasa.gov/edu/teach/activity/using-light-to-study-planets/

https://almascience.eso.org/alma-science/planet-forming-disks

according to the solar nebular disk model (SNDM), 4.6 billion years ago our solar system would have looked something like the picture below: a dusty protoplanetary disk swirling around the young sun

but this isn't a drawing of what our solar system might have looked like...

the young star is in here

the dark gaps may be where planets have formed and collected and cleaned up all the dust

ALMA - the Atacama Large Millimeter/submillimeter Array is **a radio telescope** that looks at cosmic light that isn't visible to human eyes: between radio and infrared.

HLTau 2020 conference YouTube channel

this is based on an actual image of a planetary disk orbiting a far off star, hundreds of light years away, imaged by the ALMA telescope

these bright rings are dusty material

radio astronomers use radiowaves to study things in space that emit radiowaves: stars (and the disks around them), galaxies, quasars, pulsars, and masers

exoplanetary disk based on image from: ALMA (ESO/NAOJ/NRAO), S. Andrews et al.; NRAO/AUI/NSF, S. Dagnello [public.nrao.edu/gallery/]

ALMA antenna cropped from: ESO/B. Tafreshi [twanight.org]

https://www.eso.org/public/news/eso1611/

satellites

In astronomy and planetary science, satellite can mean celestial bodies that orbit others (like moons) or it can refer to artificial or communications satellites that orbit Earth or other planetary bodies and relay back radio signals, capture images, or house other remote-sensing hardware. Here, we're using the term satellite to refer to the artificial, engineered kind.

Satellites allow us to gather information about other planets: to take detailed images of their surfaces and map their geology, to plan landing sites for future missions, to track the movement of the crust and monitor volcanoes (including cryovolcanoes on icy bodies like Enceladus), to measure the atmospheric composition, to investigate the interior through magnetic and gravity measurements.

Satellites orbiting Earth are very useful too: **geodesists** use data from satellites built by **engineers** to track the movement of tectonic plates and sea level changes on the millimeter scale; **you** use satellite-based radionavigation every time you use **GPS** or Google Maps; **meteorologists** use satellites to forecast and model weather systems; **atmospheric scientists** use a variety of different satellite data to monitor atmospheric composition and air pollution; **ecologists, environmental scientists, geographers** and other scientists use satellite imagery to estimate woodland cover, animal migration, desertification, flooding and many other natural and human-caused processes; **geophysicists** use satellite-mounted magnetometers and gravimeters to investigate our planet's interior.

https://www.esa.int/Applications/Observing_the_Earth/ | https://solarsystem.nasa.gov/ | https://solarsystem.nasa.gov/moons/jupiter-moons/europa/in-depth/

Printing: choose fit to page/scale to fit then trim the border with a scissors

WHERE TO GO FROM HERE

- Research further - use the references inside as a jumping off point!
- Look up the different space careers in **bold** in the text (see also: https://spacecareers.uk/?p=job_profiles/)
- Look up "citizen science" projects to get involved in space research - Zooniverse.org is a good start.

Made by MMQ

planetary exploration

a pocket-sized guide

SPACE HUB YORKSHIRE