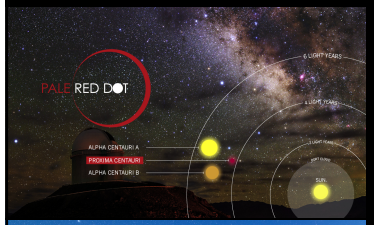
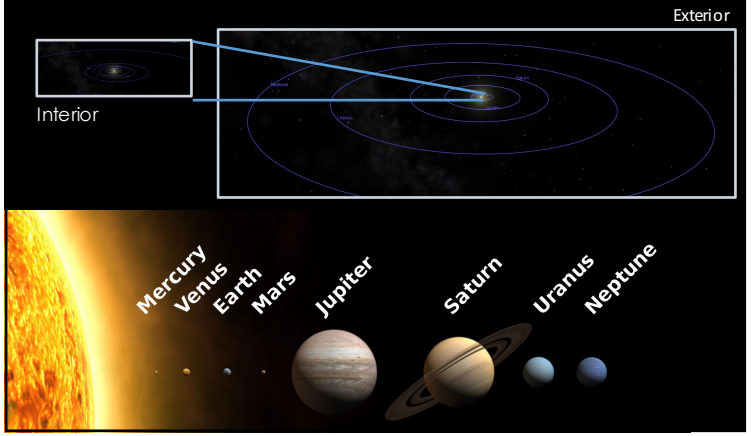
Proxima b and the search for life beyond the Solar System

Guillem Anglada-Escudé
Queen Mary University of London

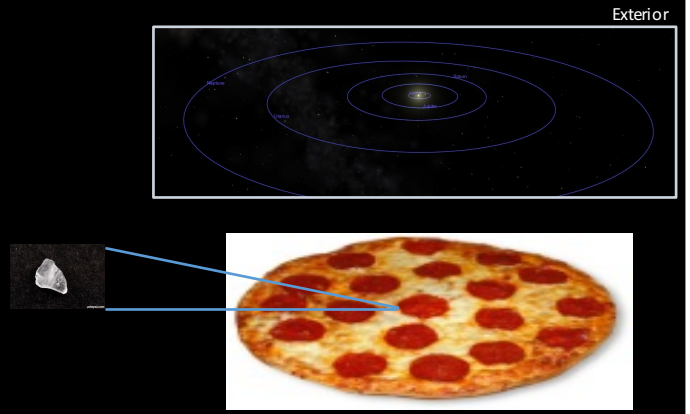


PHL – A. Mendez

The Solar System



The Solar System



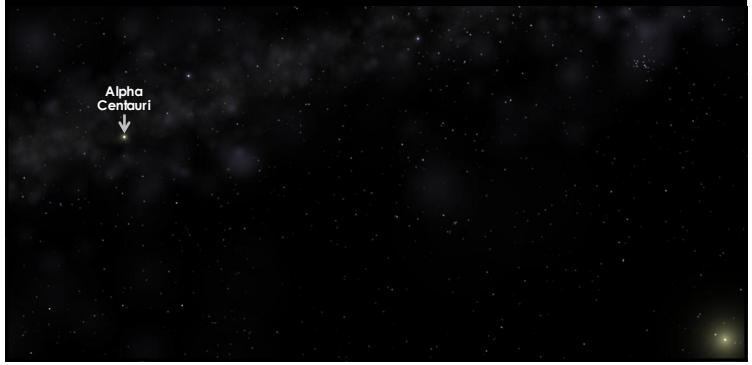
The Solar System

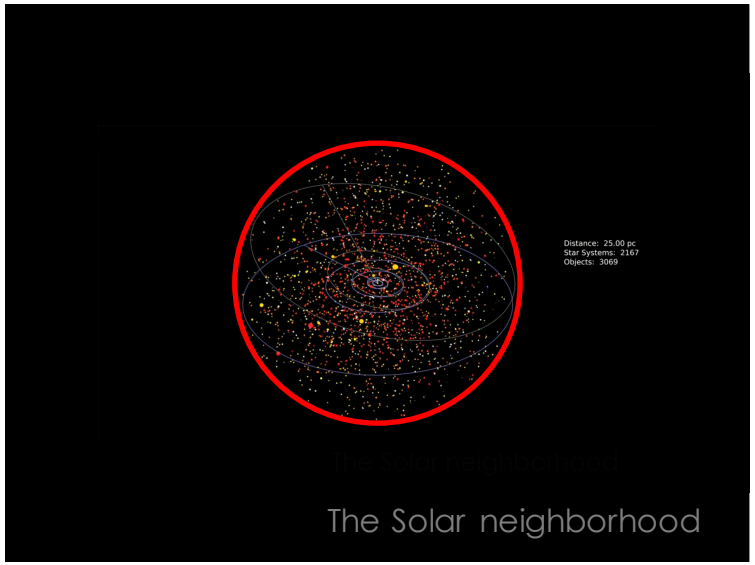
Grain of salt (0.2 mm)

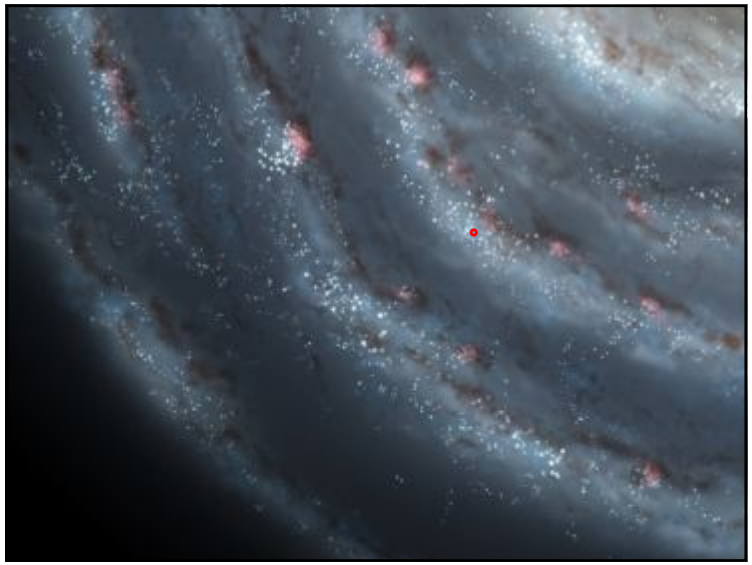
Earth-moon system

Nearest stars

Nearest stars

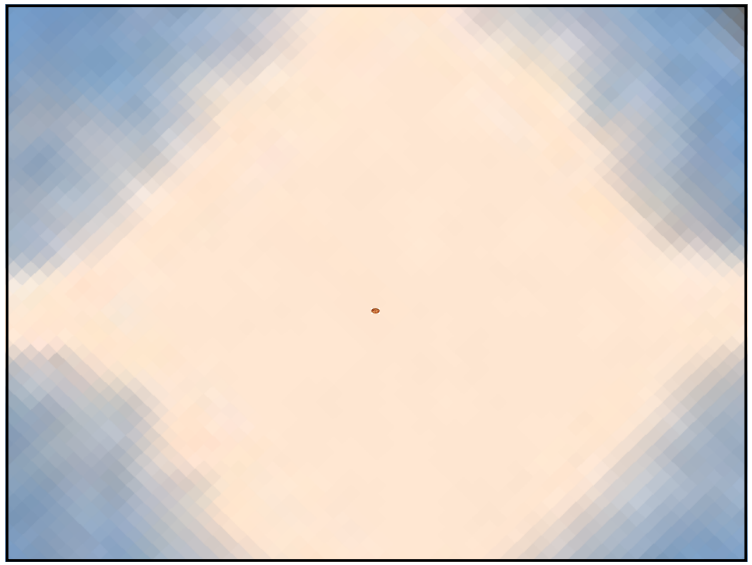




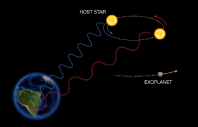


Finding exoplanets

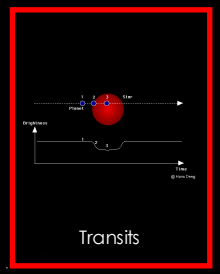
It's complicated…
Tau Ceti
Spectral type : G8V
Distance : 11.9 light-years



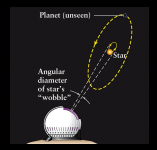
How we find exoplanets?



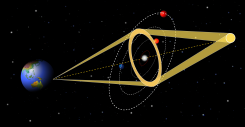
Radial velocity



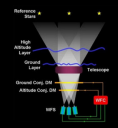
Transits



Astrometry

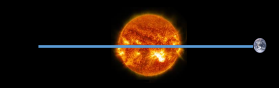


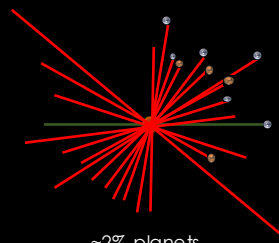
Microlensing



Direct imaging

Transit photometry



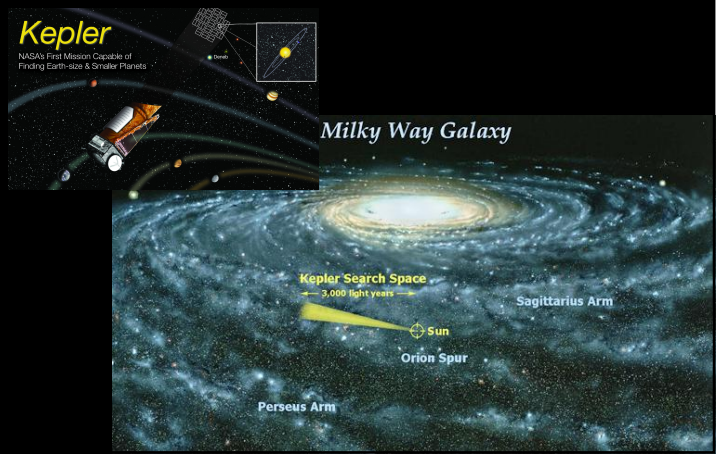


110 000 stars

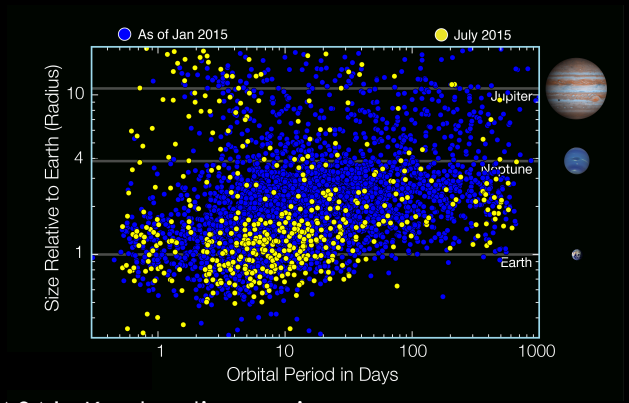
~2% planets transit → ~2200 planets

but ~4000 candidates!!

Transit photometry

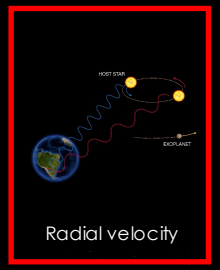


Transit photometry

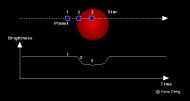


NASA's Kepler discoveries

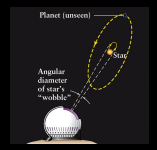
How we find exoplanets?



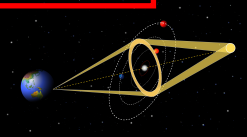
Radial velocity



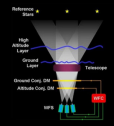
Transits



Astrometry

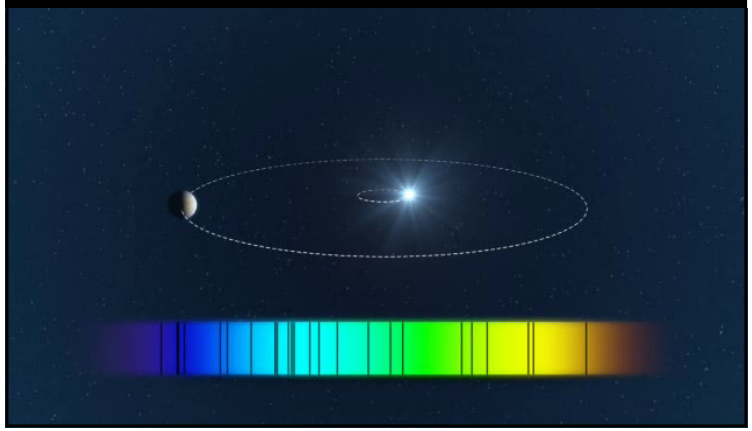


Microlensing

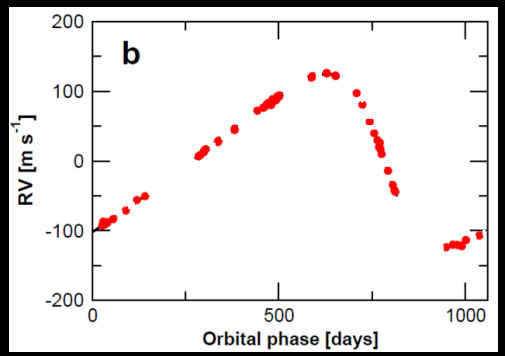


Direct imaging

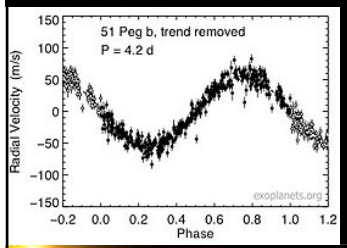
The Doppler method



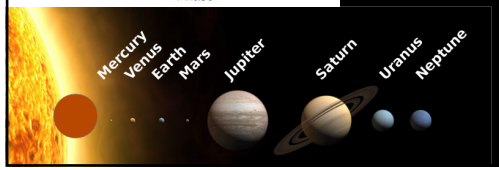
The Doppler method



The Doppler method

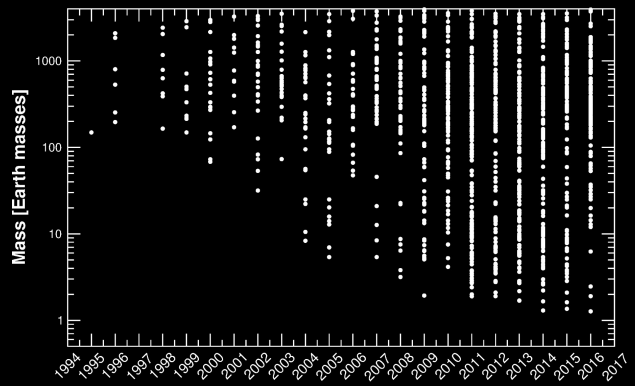


Nov 1995

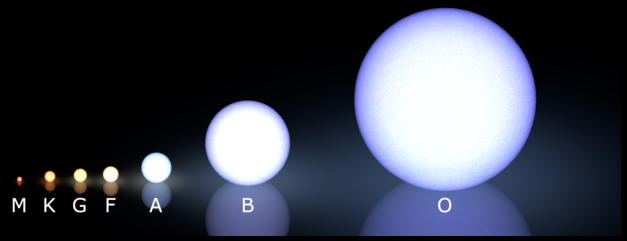


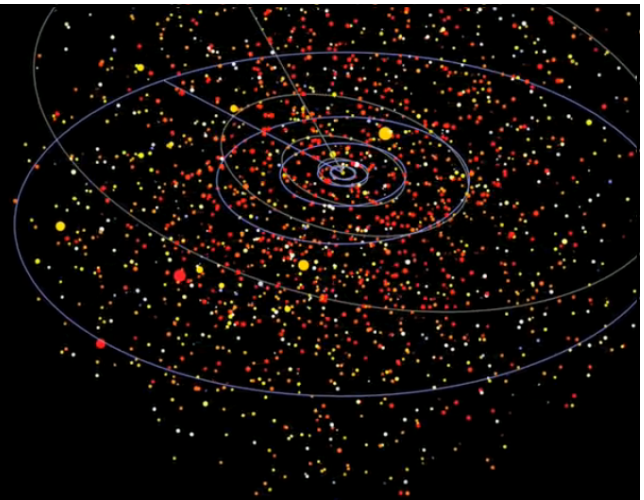
Michel Mayor
Didier Queloz

The Doppler method

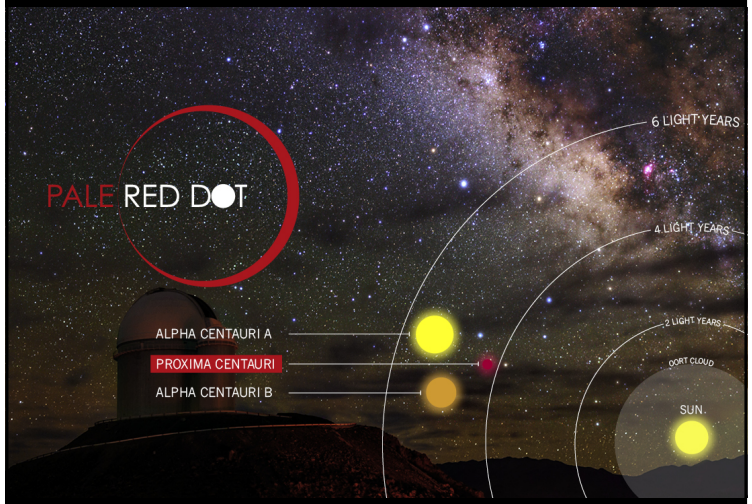


The Doppler method





Planets around red-dwarfs

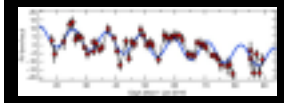


Pale Red Dot

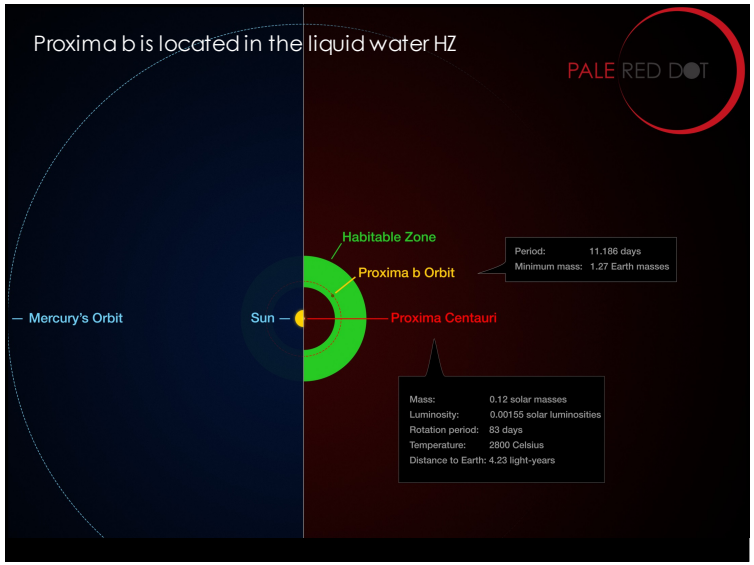
Pale Red Dot

Signal
Amplitude : **1.4 m/s**
Orbital period : **11.2 days**

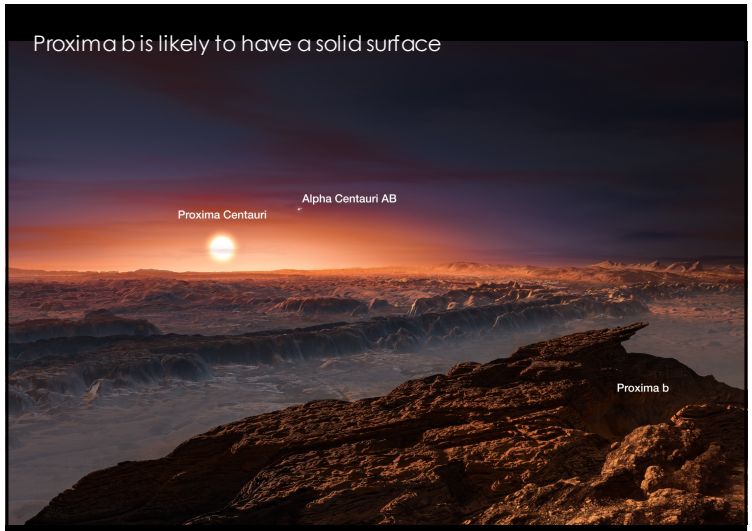
Proxima b
Min. mass : **1.3 Mearth**
Orb. distance : **5% of an AU**
Irradiance : **65% of Earth's**
Eq. temperature : **~235 K (-40 C)**

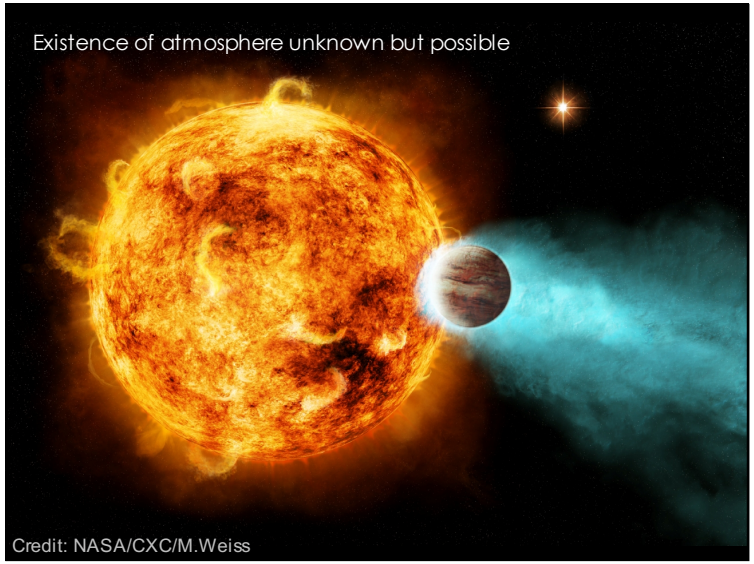


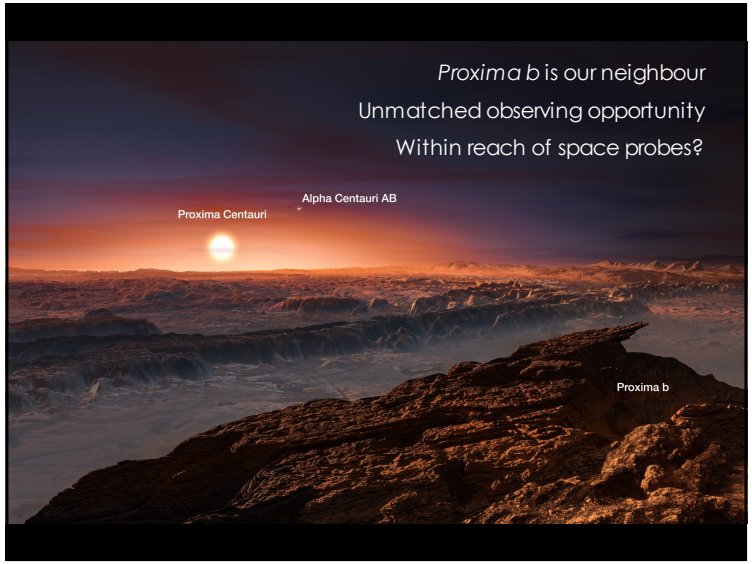
Proxima b is located in the liquid water HZ

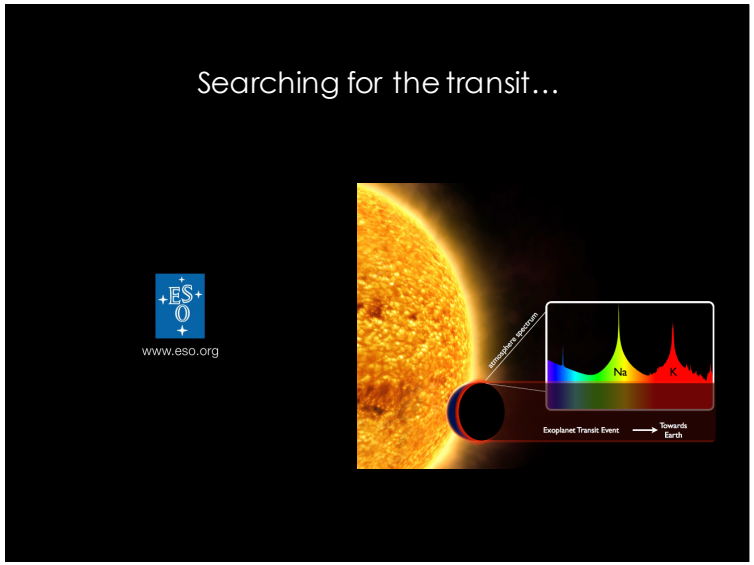


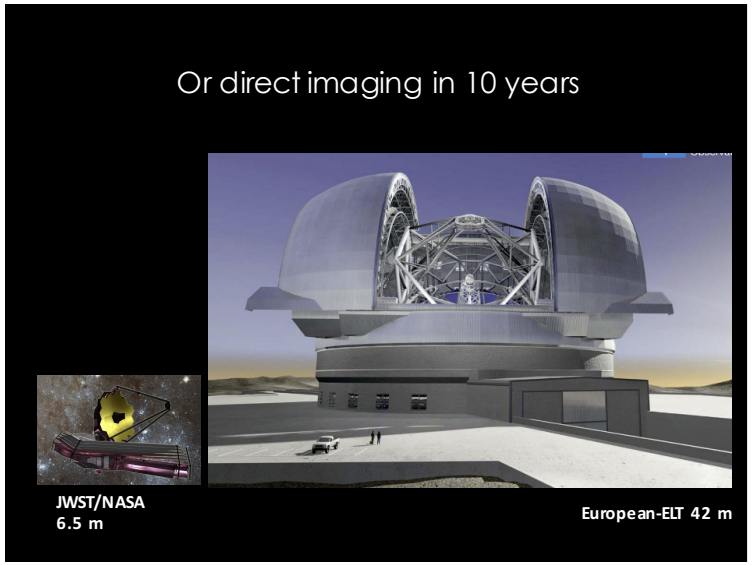
Proxima b is likely to have a solid surface

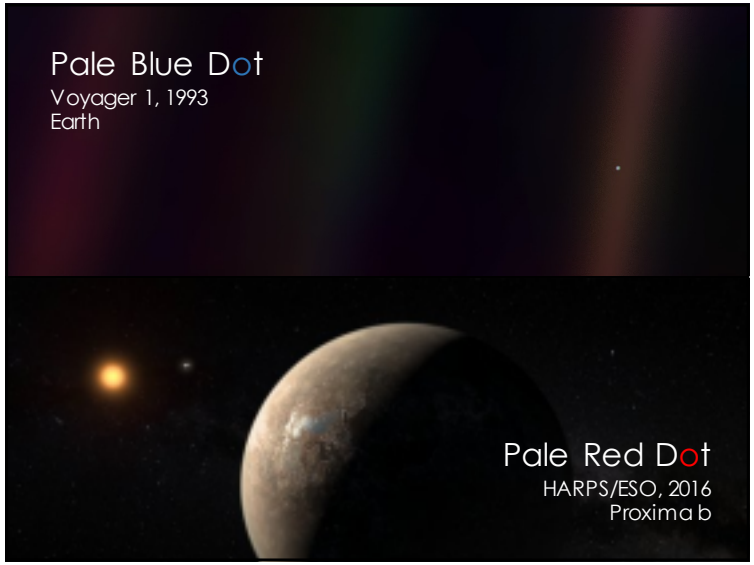



Existence of atmosphere unknown but possible
Credit: NASA/CXC/M.Weiss

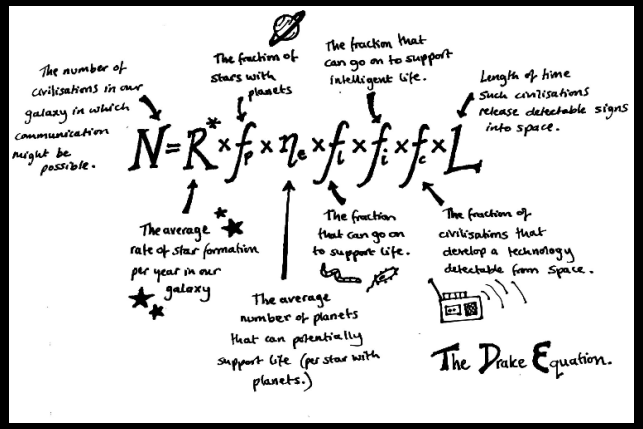

Proxima b is our neighbour
Unmatched observing opportunity
Within reach of space probes?
Alpha Centauri AB
Proxima Centauri
Proxima b


Searching for the transit…
www.eso.org
Na
K
Exoplanet Transit Event
Towards Earth

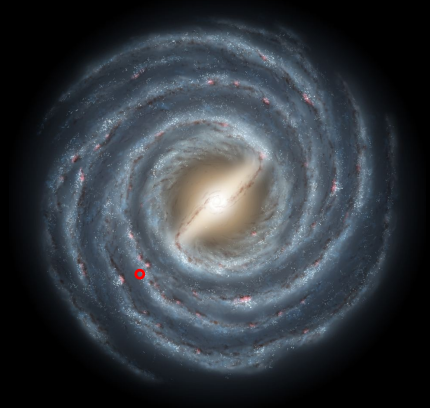

Or direct imaging in 10 years
JWST/NASA
6.5 m
European-ELT 42 m



Drake's equation

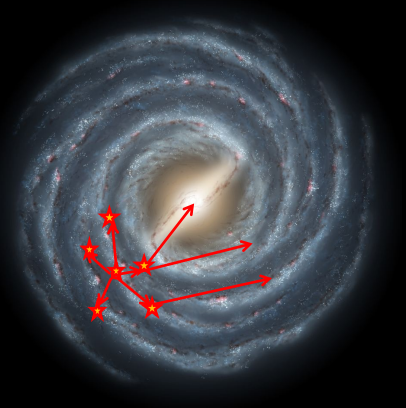


Fermi's paradox



1000 years

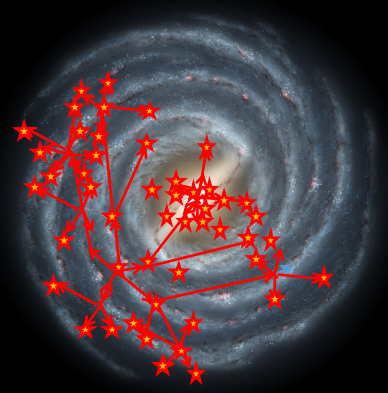
Fermi's paradox



1000 years

30 000 years

Fermi's paradox

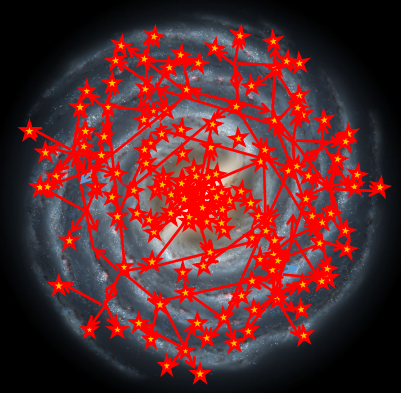


1000 years

30 000 years

300 000 years

Fermi's paradox



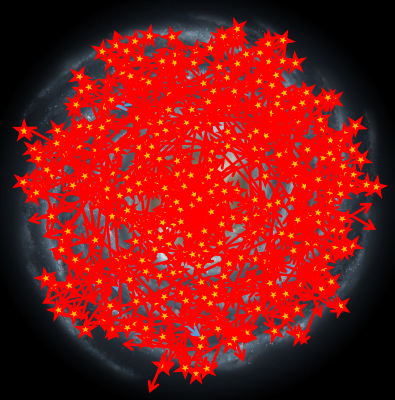
1000 years

30 000 years

300 000 years

1 000 000 years

Fermi's paradox



1000 years

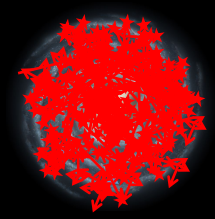
30 000 year

300 000 years

1 000 000 years

10 000 000 years

Fermi's paradox



10 Myr << 15 bilion Myr

$$N = R^* \times f_p \times n_e \times f_l \times f_i \times f_c$$

1.5 x $f_l f_i f_c$ / year

Why nobody talks to us?