

PLANEETATMOSFEREN

A stylized graphic of a location pin with a rainbow spectrum as its tail, set against a starry space background with a large yellow sun.

OP ZOEK NAAR DE GLOED VAN LEVEN

LUCAS ELLERBROEK - CURSUS 'WAT LEERT WEBB ONS' - AMERSFOORT, 16 APRIL 2025

PLANEETATMOSFEREN

- Atmosferen in ons zonnestelsel
- Exoplaneten
- Transmissiespectroscopie
- Zoektocht naar leven
- Toekomstperspectief



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De aardatmosfeer

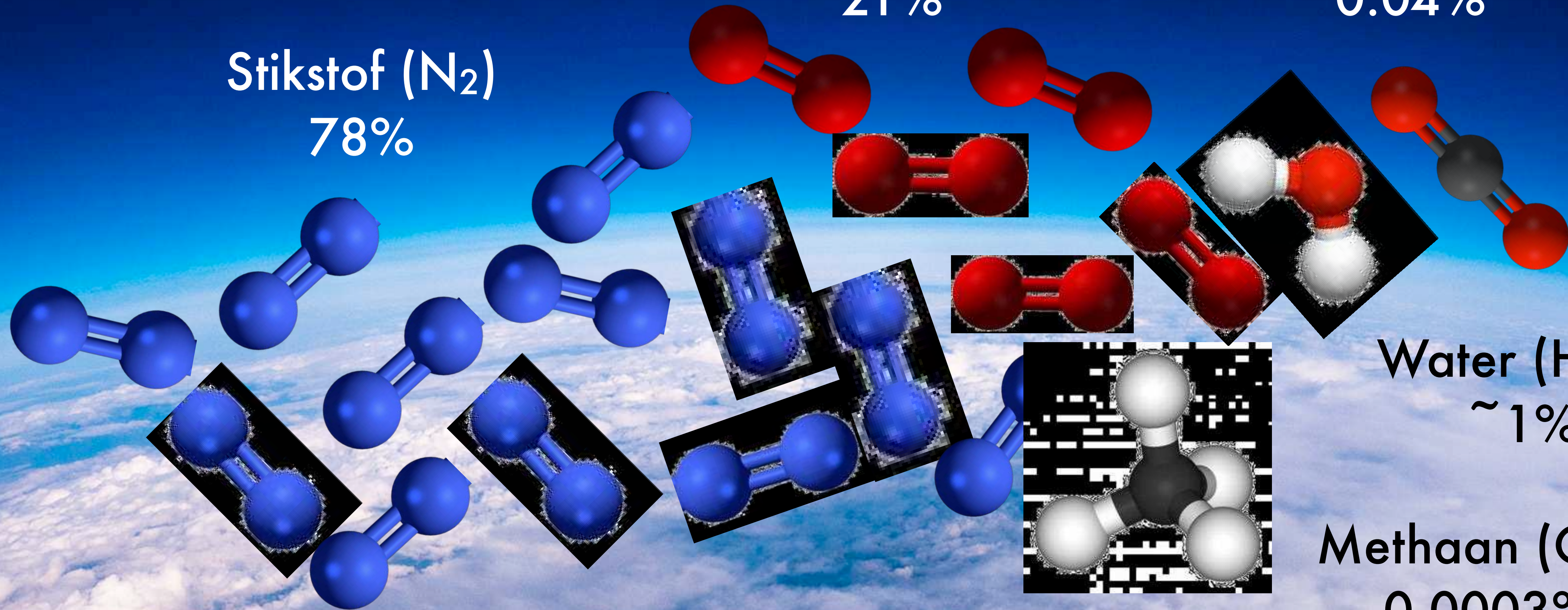
Stikstof (N_2)
78%

Zuurstof (O_2)
21%

Koolstofdioxide (CO_2)
0.04%

Water (H_2O)
~1%

Methaan (CH_4)
0.0003%



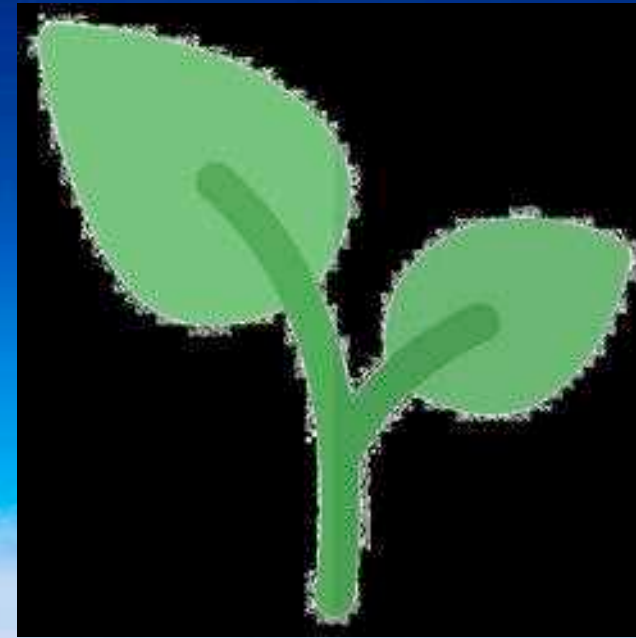
De aardatmosfeer



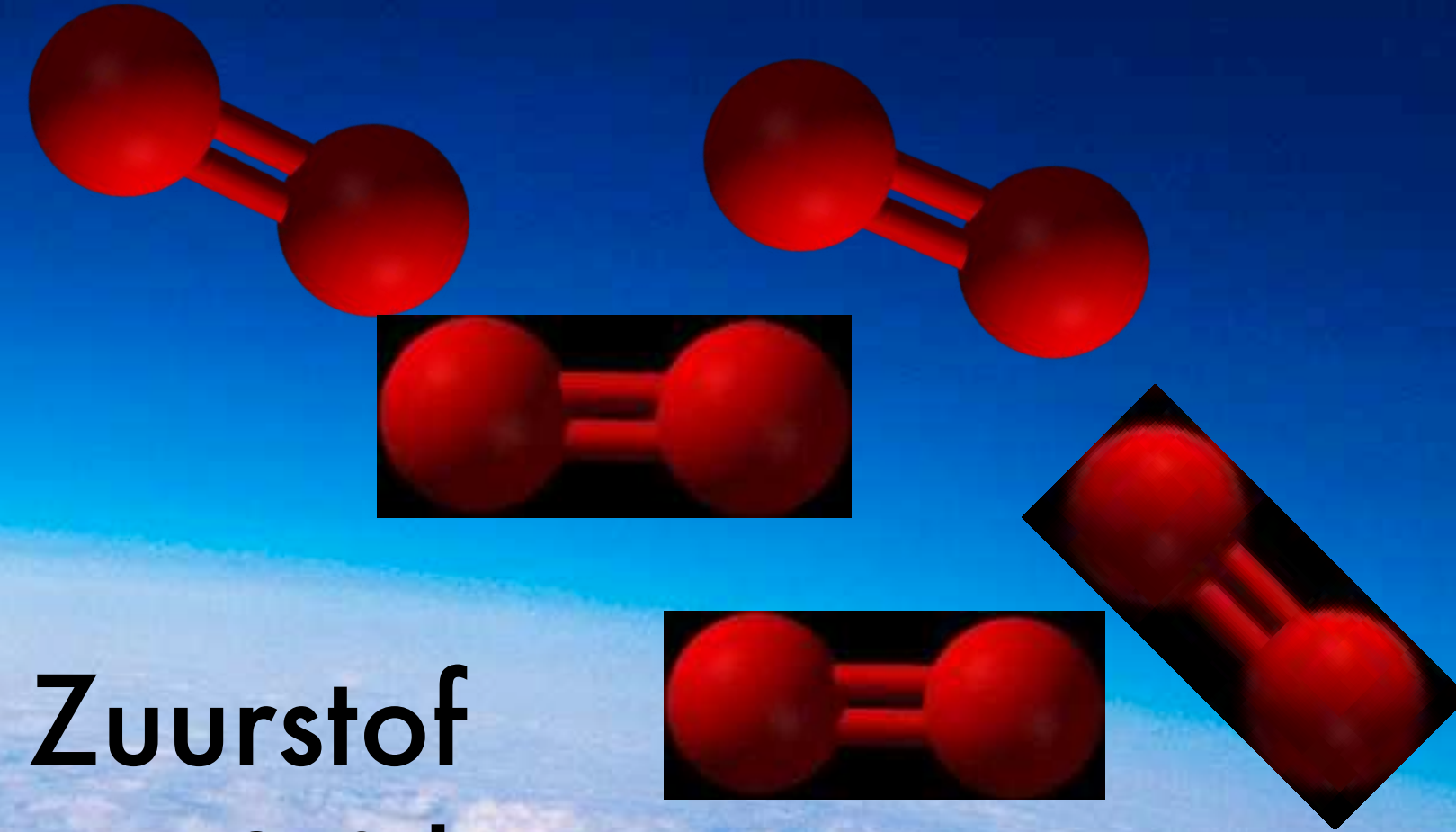
Aarde
 $6 \times 10^{24} \text{ kg}$



Atmosfeer
 $5 \times 10^{18} \text{ kg}$



Leven

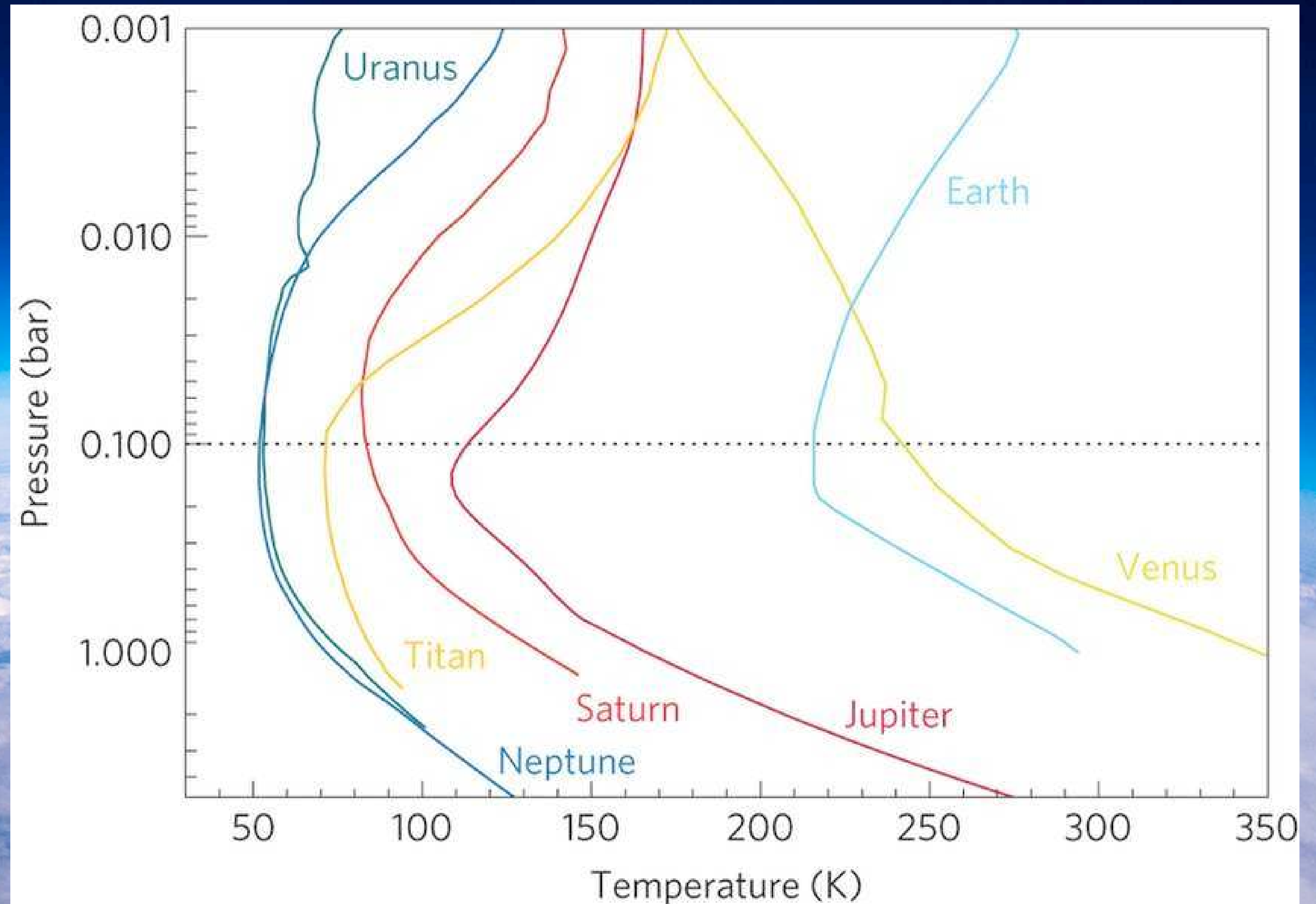
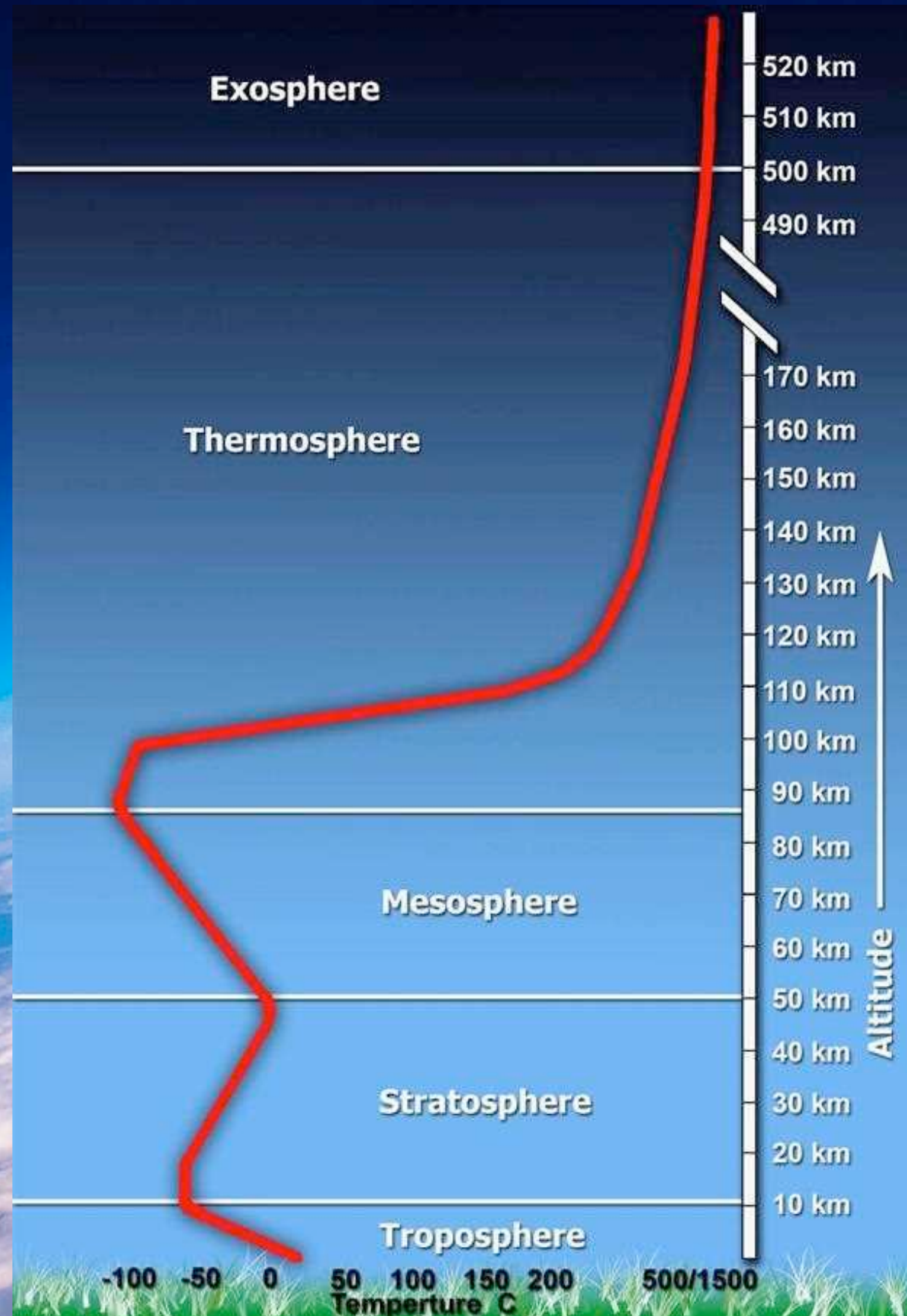


Zuurstof
 $1 \times 10^{18} \text{ kg}$

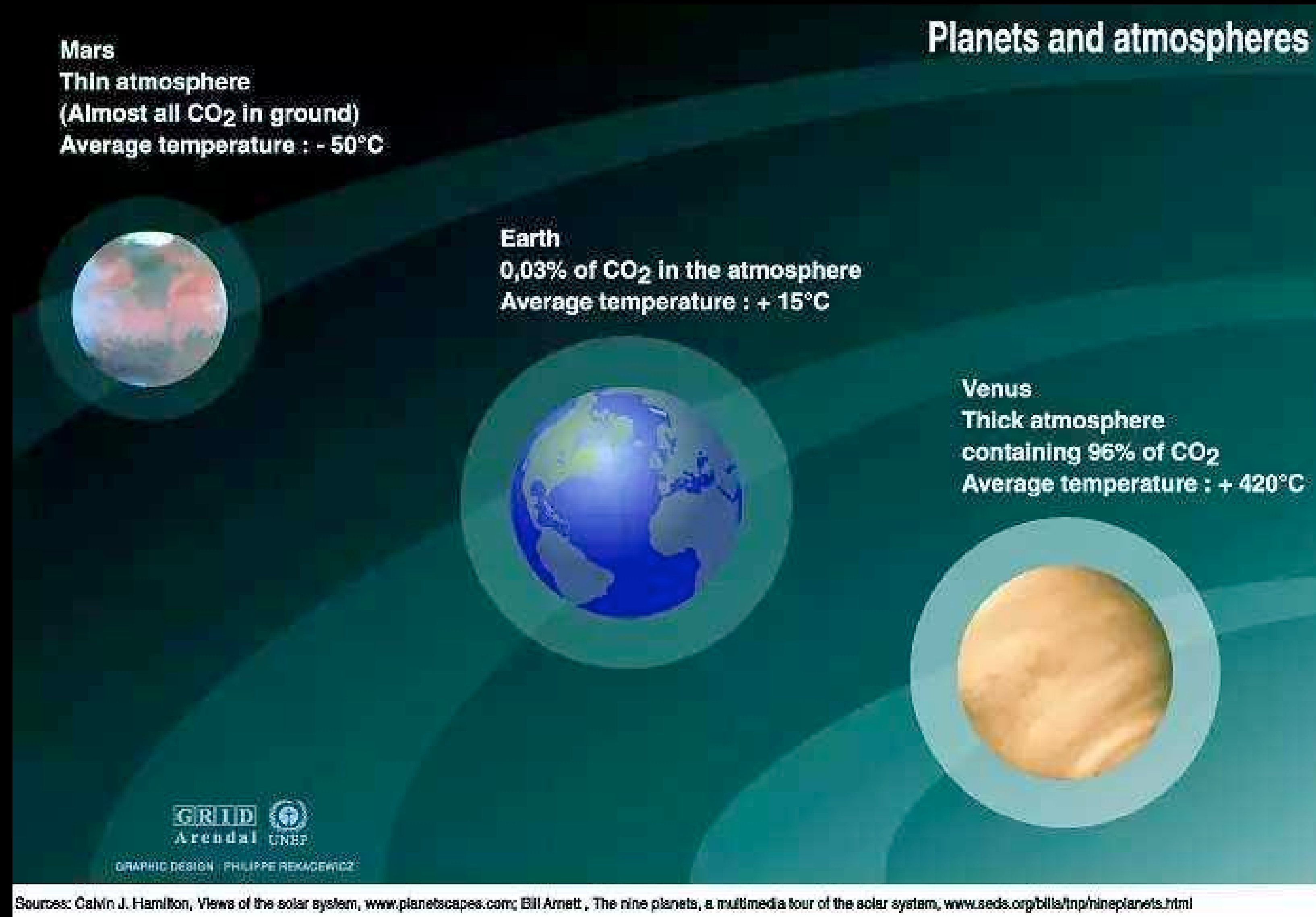


$$10 \times P_{el} = 3 \times P_{aarde})$$

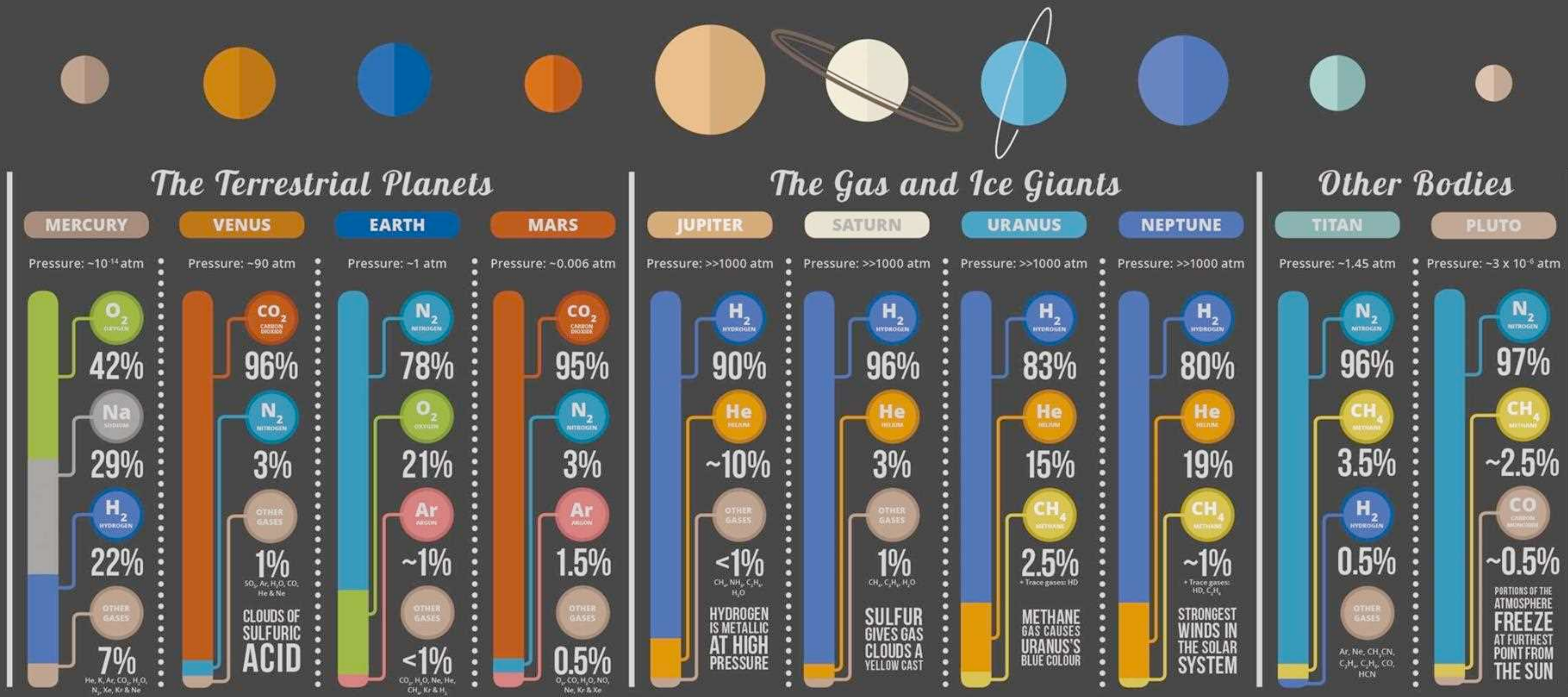
De aardatmosfeer



Atmosferen van de buren



THE ATMOSPHERES OF THE SOLAR SYSTEM



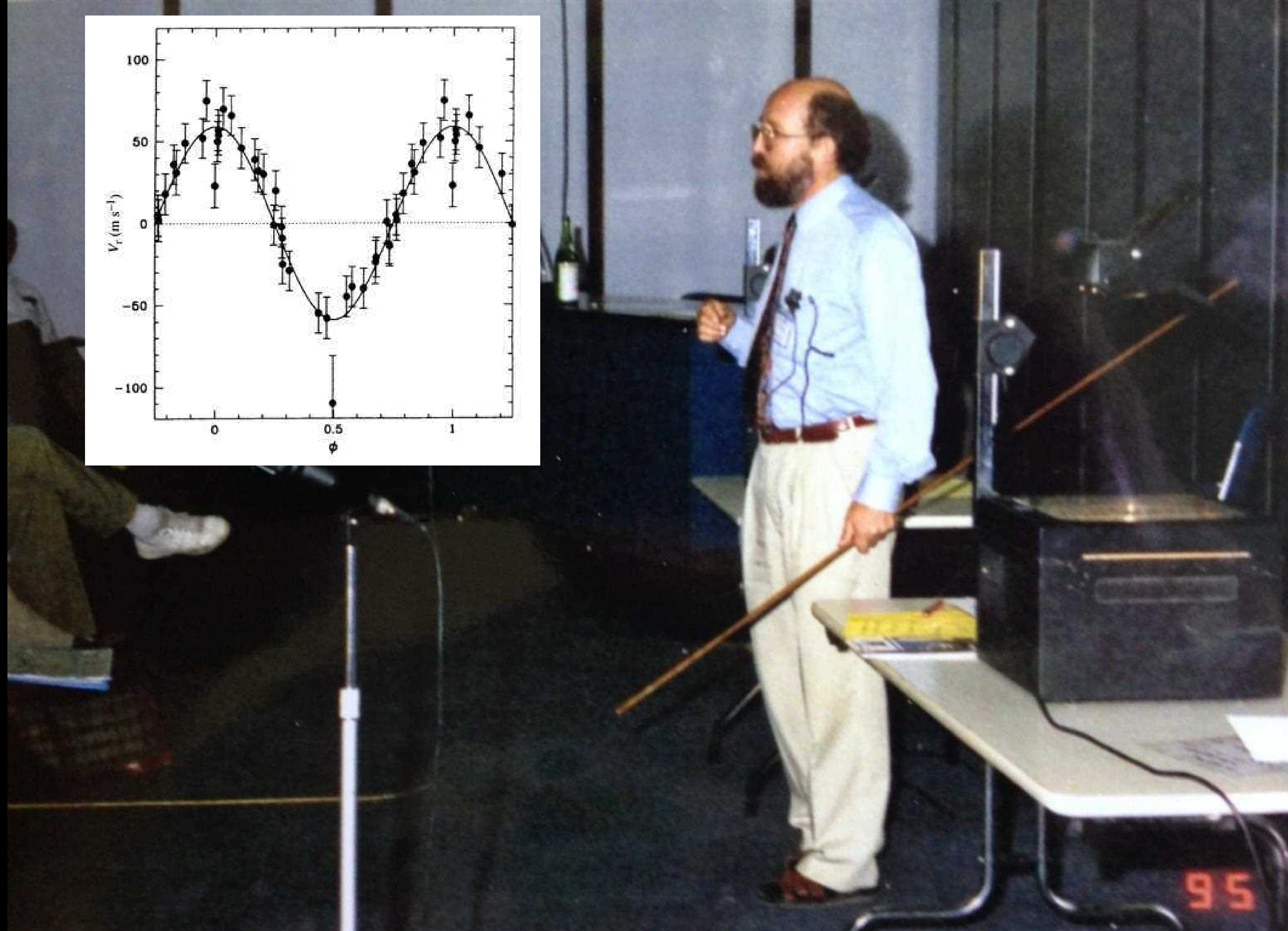
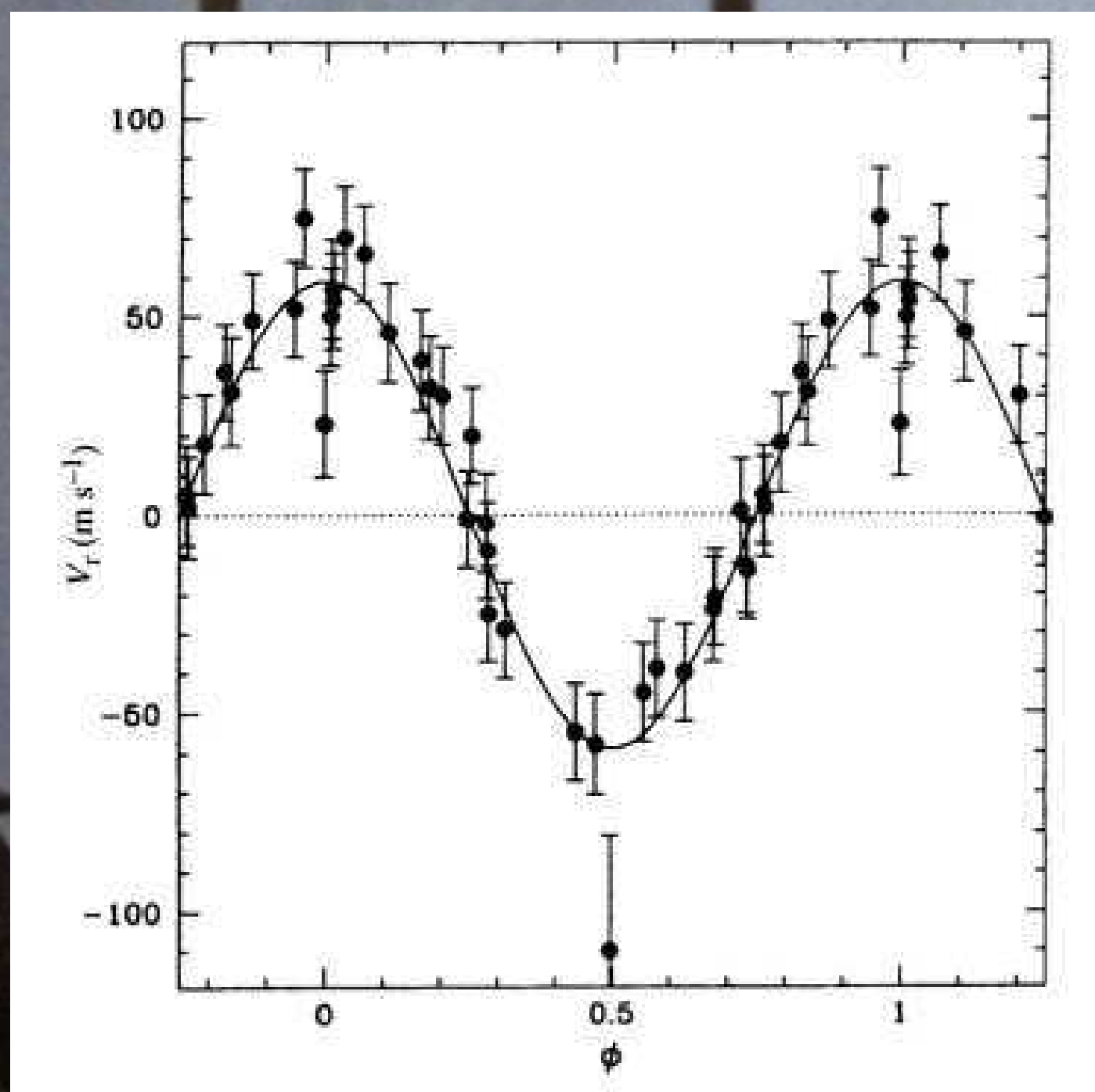
Note: Planet sizes not to scale. Pressures for terrestrial planets are surface pressures. Mercury's atmosphere is not an atmosphere in the strict sense of the word, being a trillion times thinner than Earth's.



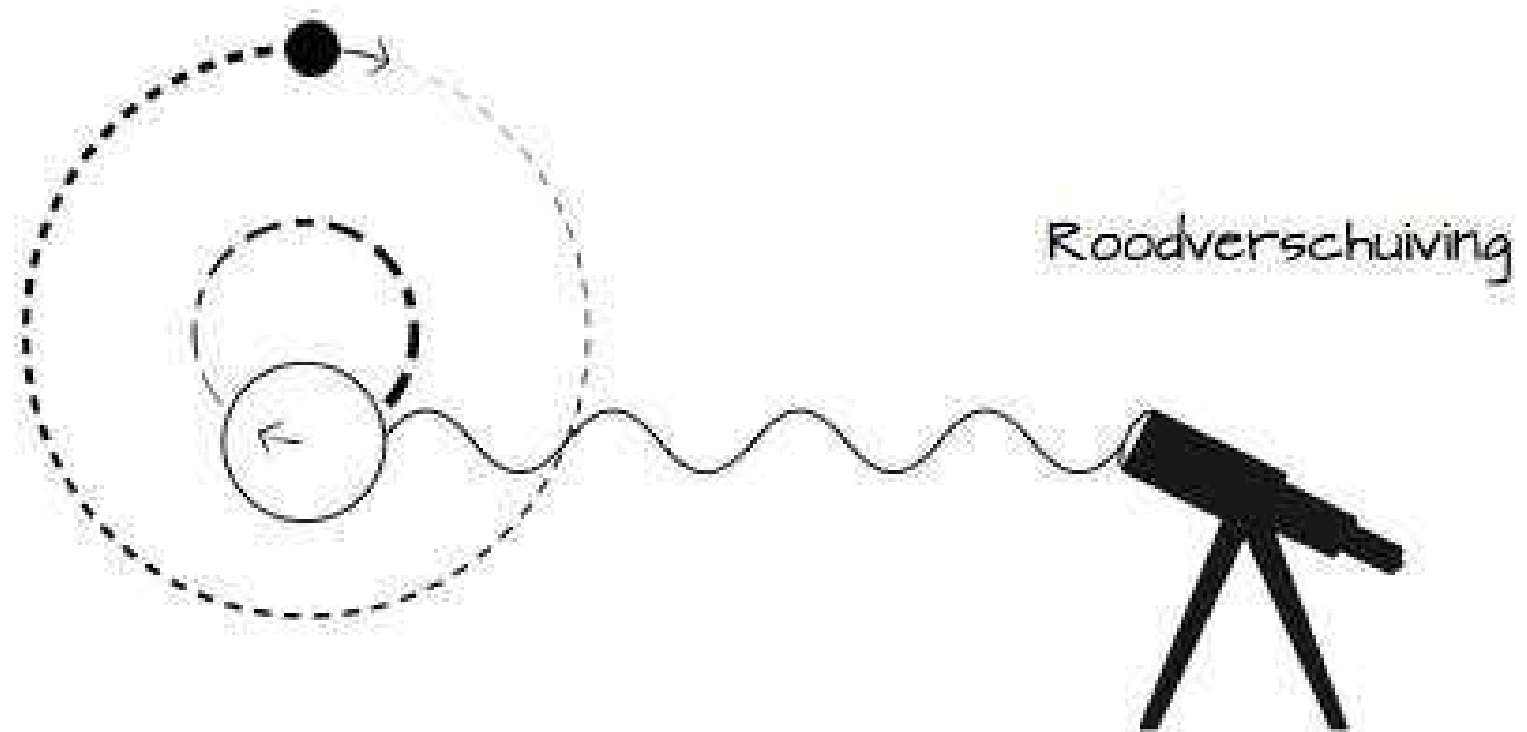
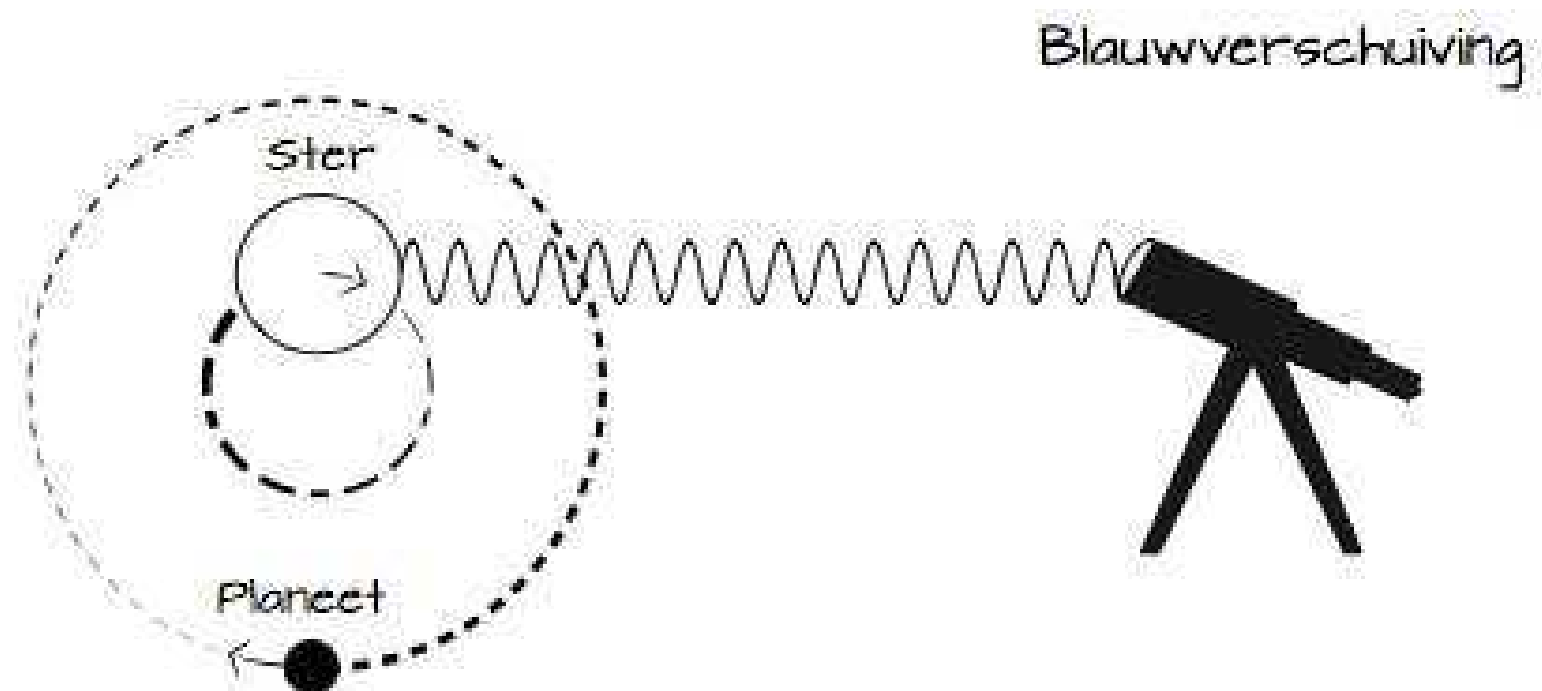
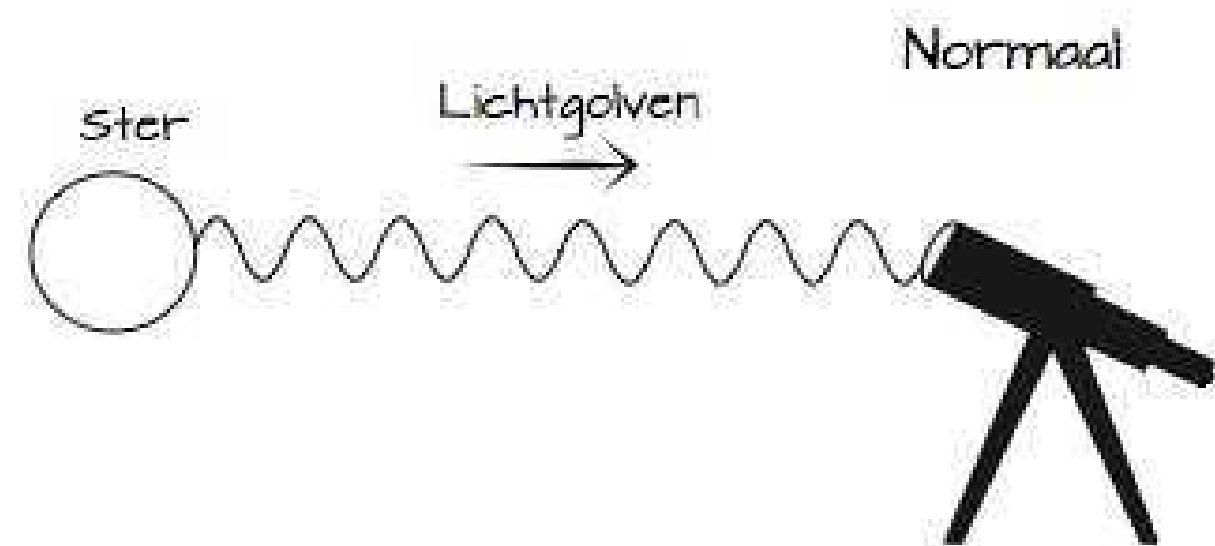
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- ♂ **Exoplaneten**
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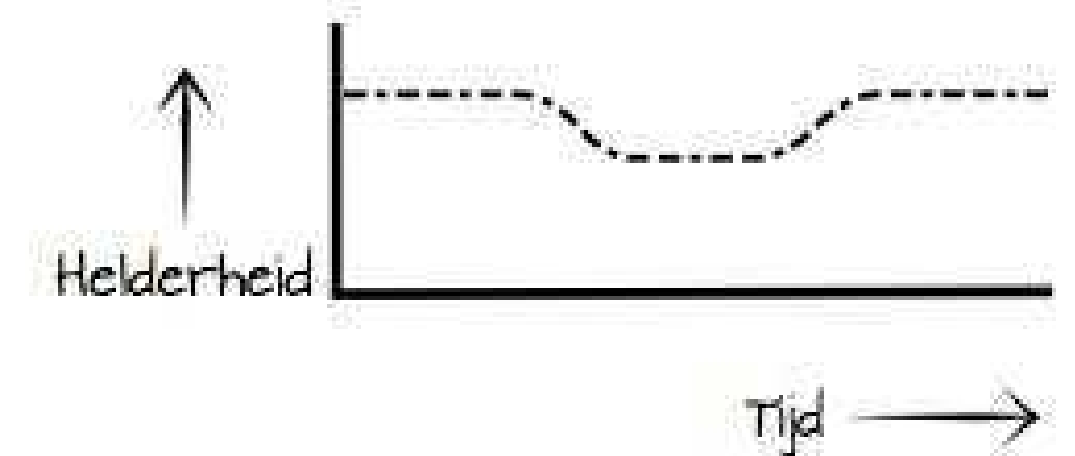
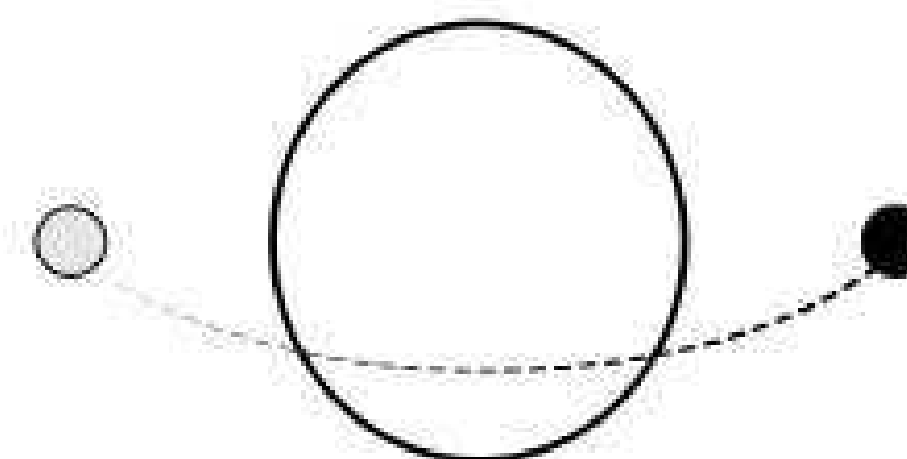
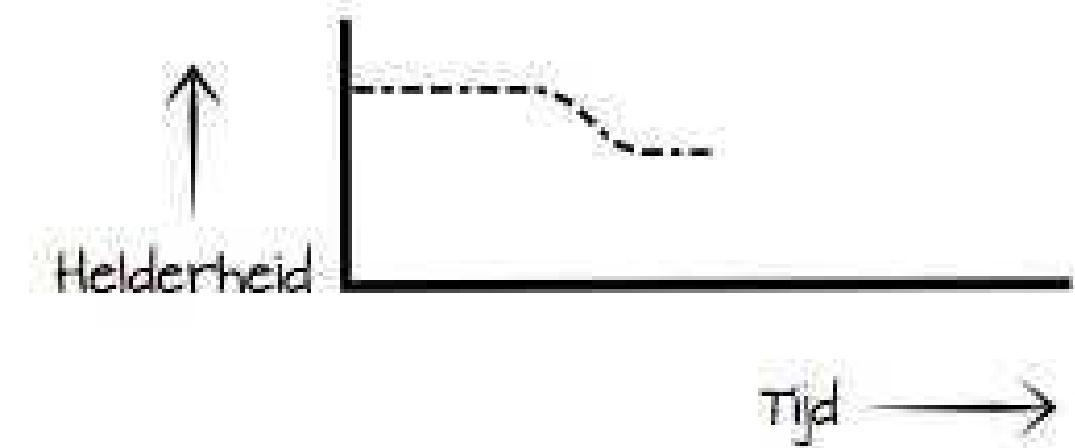
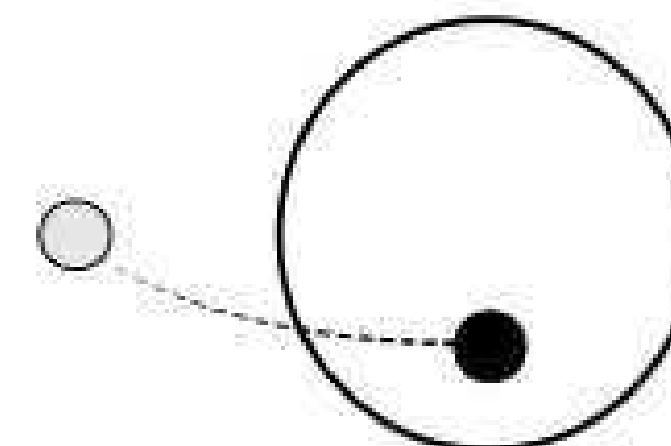
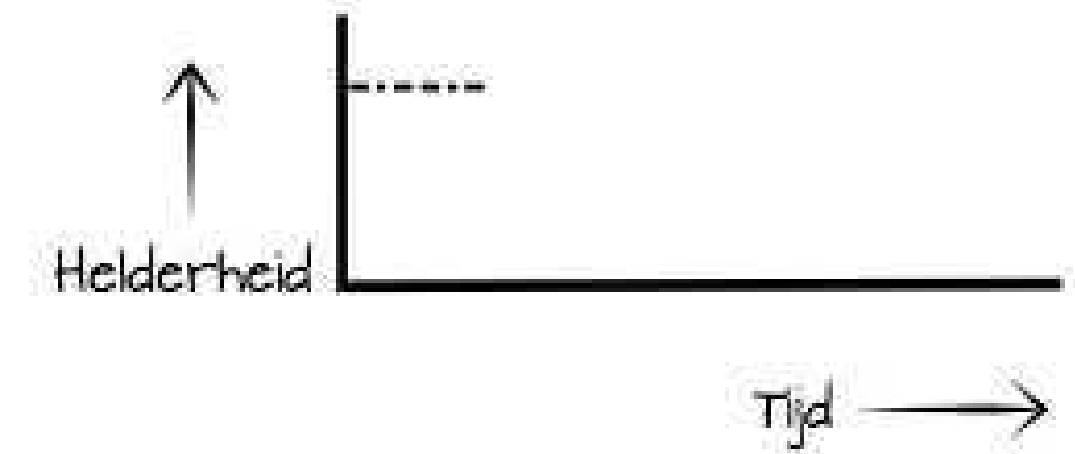
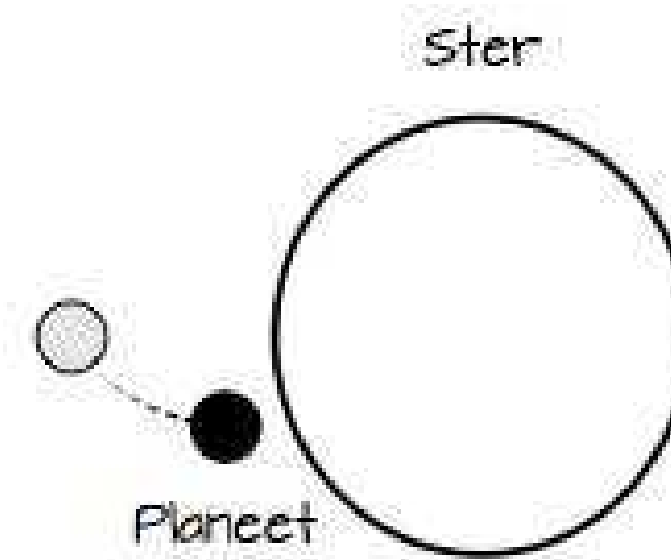


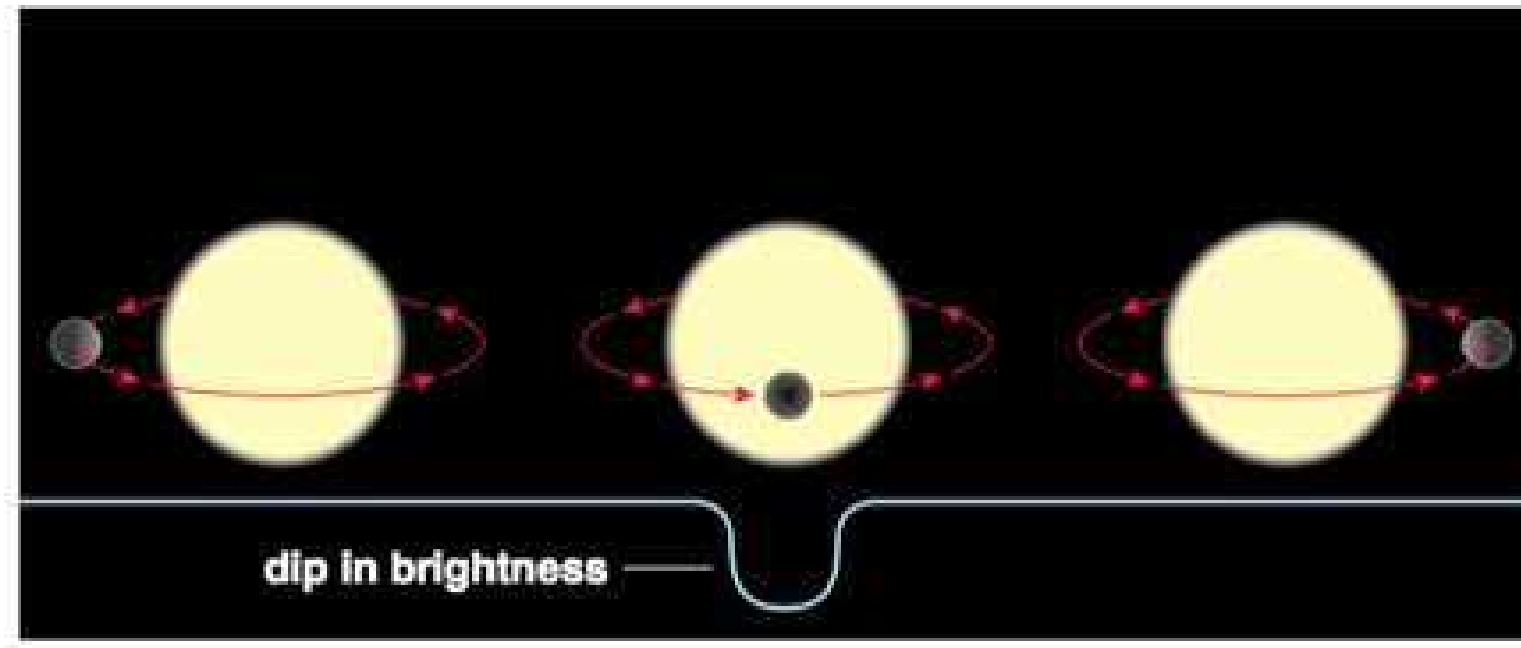


Dopplermethode

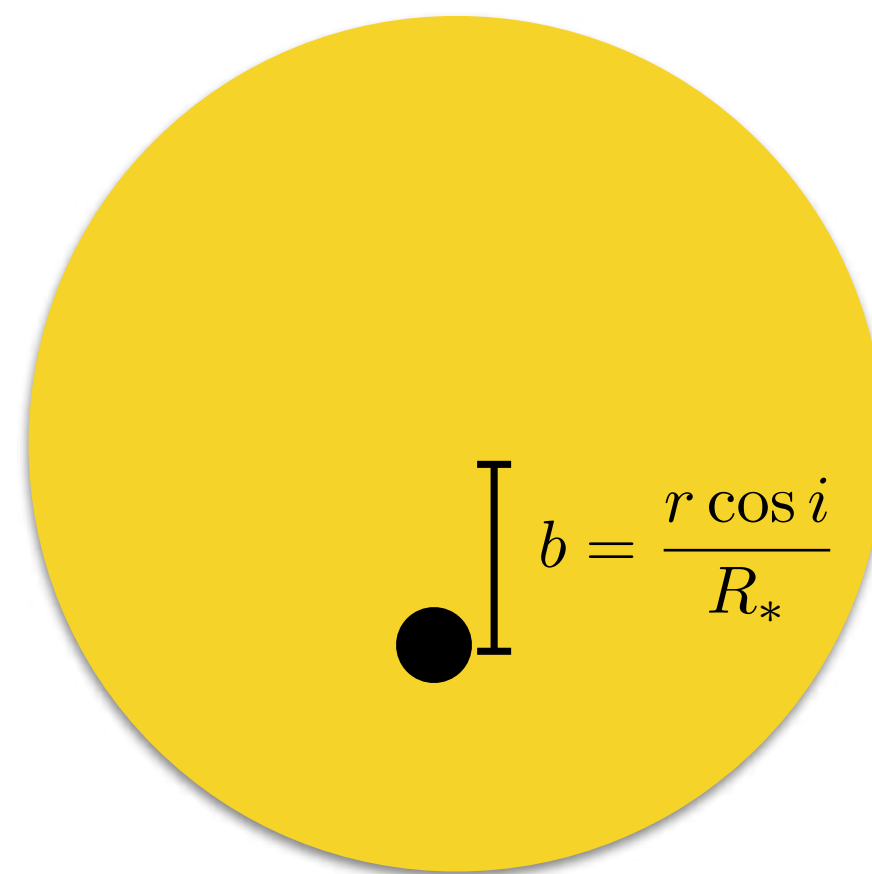


Transitmethode

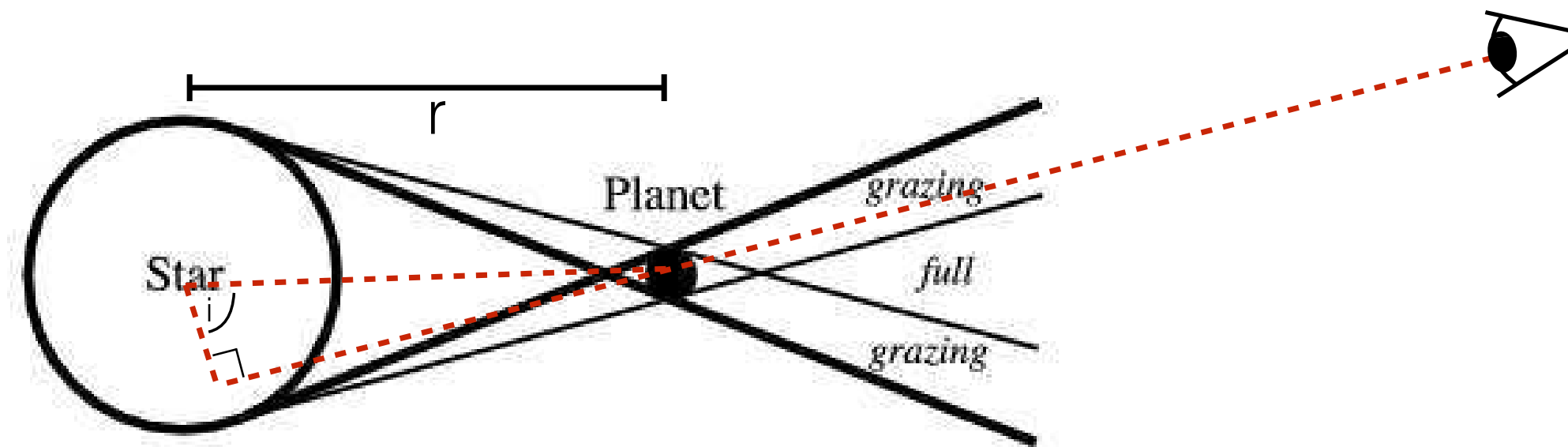




$$\frac{\Delta L}{L} = \left(\frac{R_p}{R_*} \right)^2$$

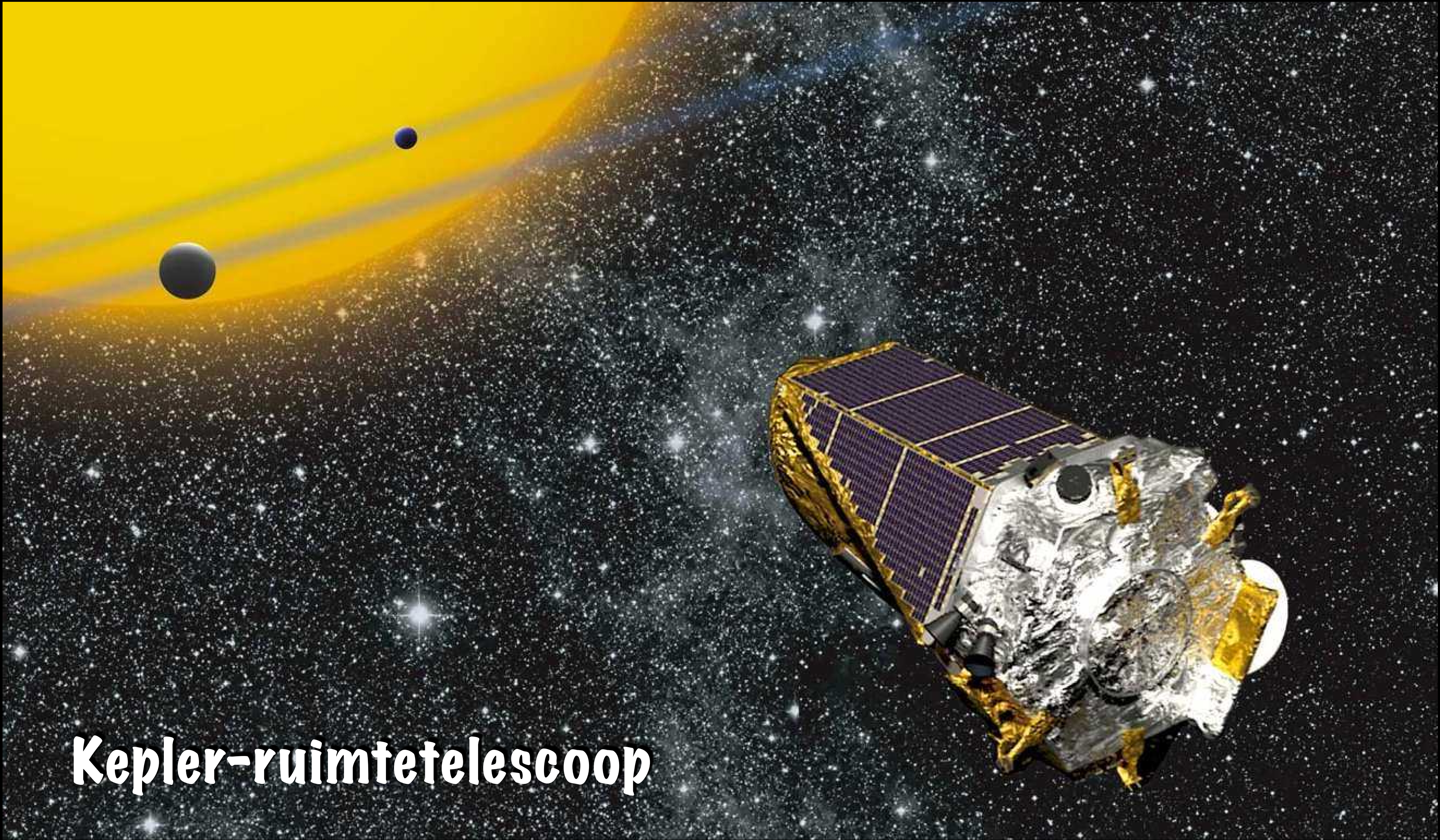


b: 'impactparameter':
schijnbare afstand planeet-ster
halverwege transit



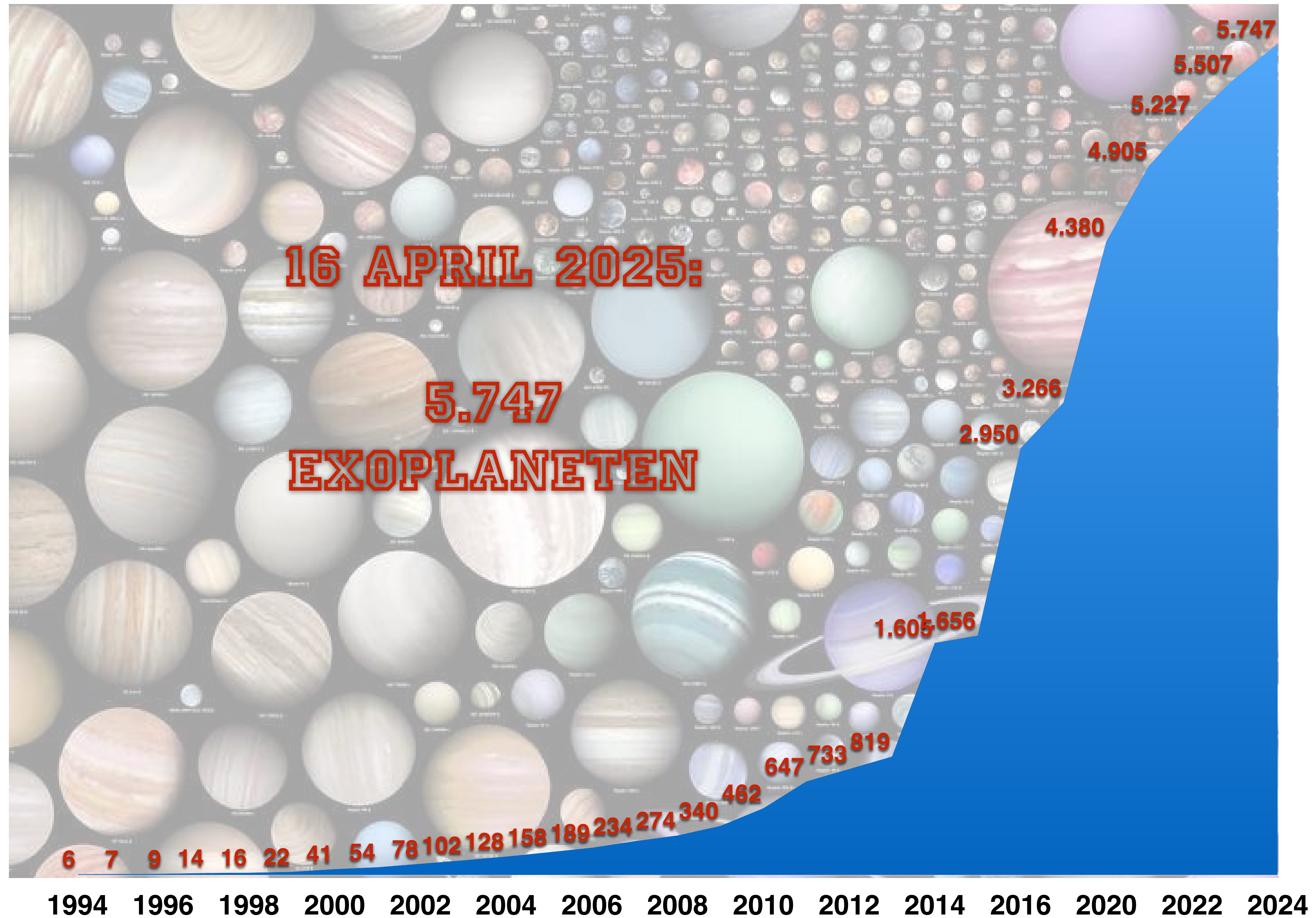
- $r \cos i > R_* + R_p$ geen transit
- $r \cos i < R_* + R_p$ rand-transit
- $r \cos i < R_* - R_p$ volledige transit

Transit-methode geeft **grootte** van planeet (t.o.v. ster)
en **afstand planeet-ster** (met gebruik van 3e wet Kepler en M_{ster})

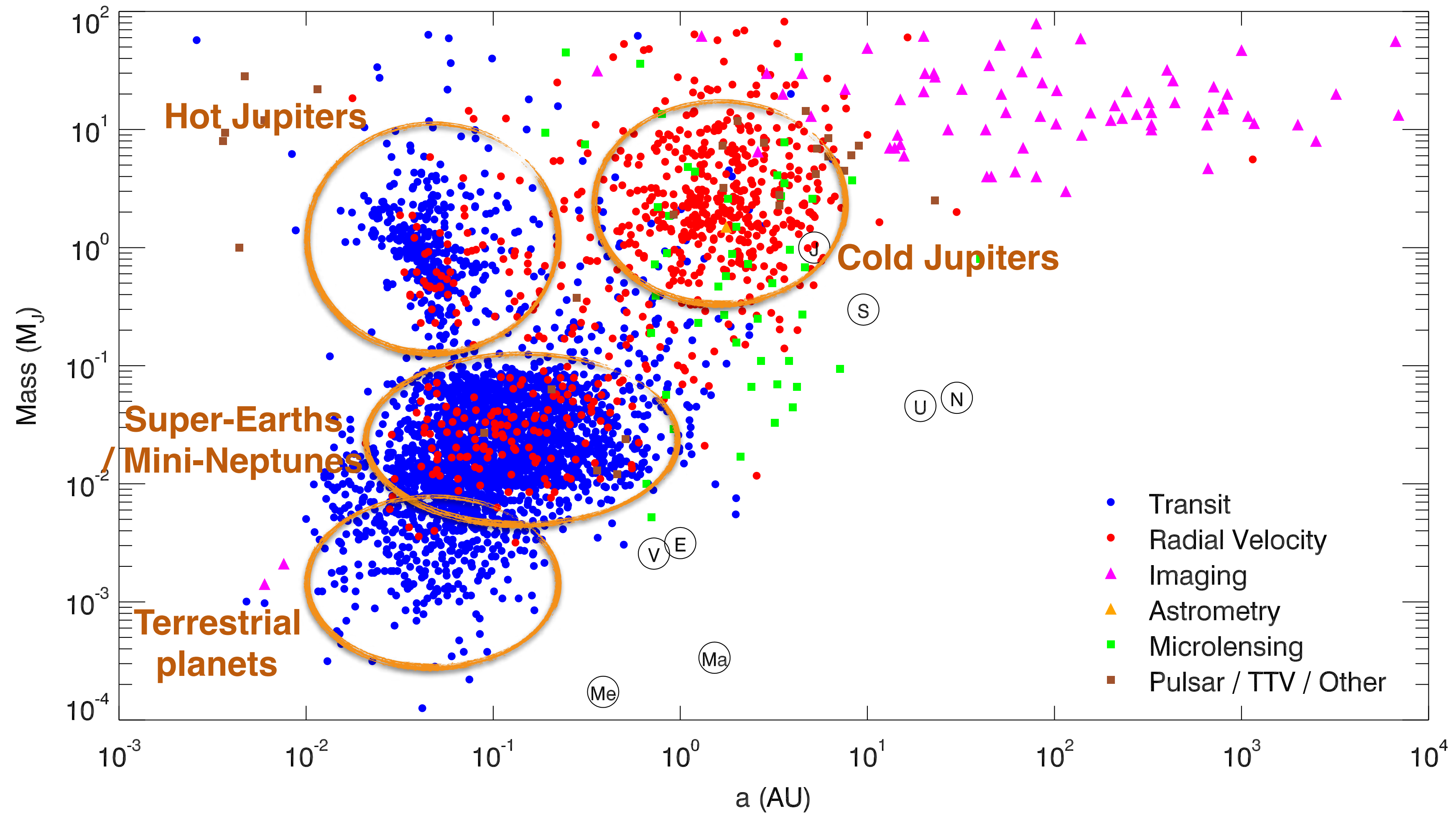
An artistic rendering of the Kepler space telescope in deep space. The telescope is a rectangular satellite with large solar panel arrays and a complex instrument bay. It is positioned in the lower right of the frame, angled towards the viewer. In the upper left, a bright yellow star is partially visible, with two dark, spherical planets in transit across its face, creating a silhouette effect. The background is a vast field of stars, with a prominent white star having diffraction spikes in the lower left. The overall scene is set against a black cosmic background.

Kepler-ruimtetelescoop

Exoplaneten: de ontdekkingen

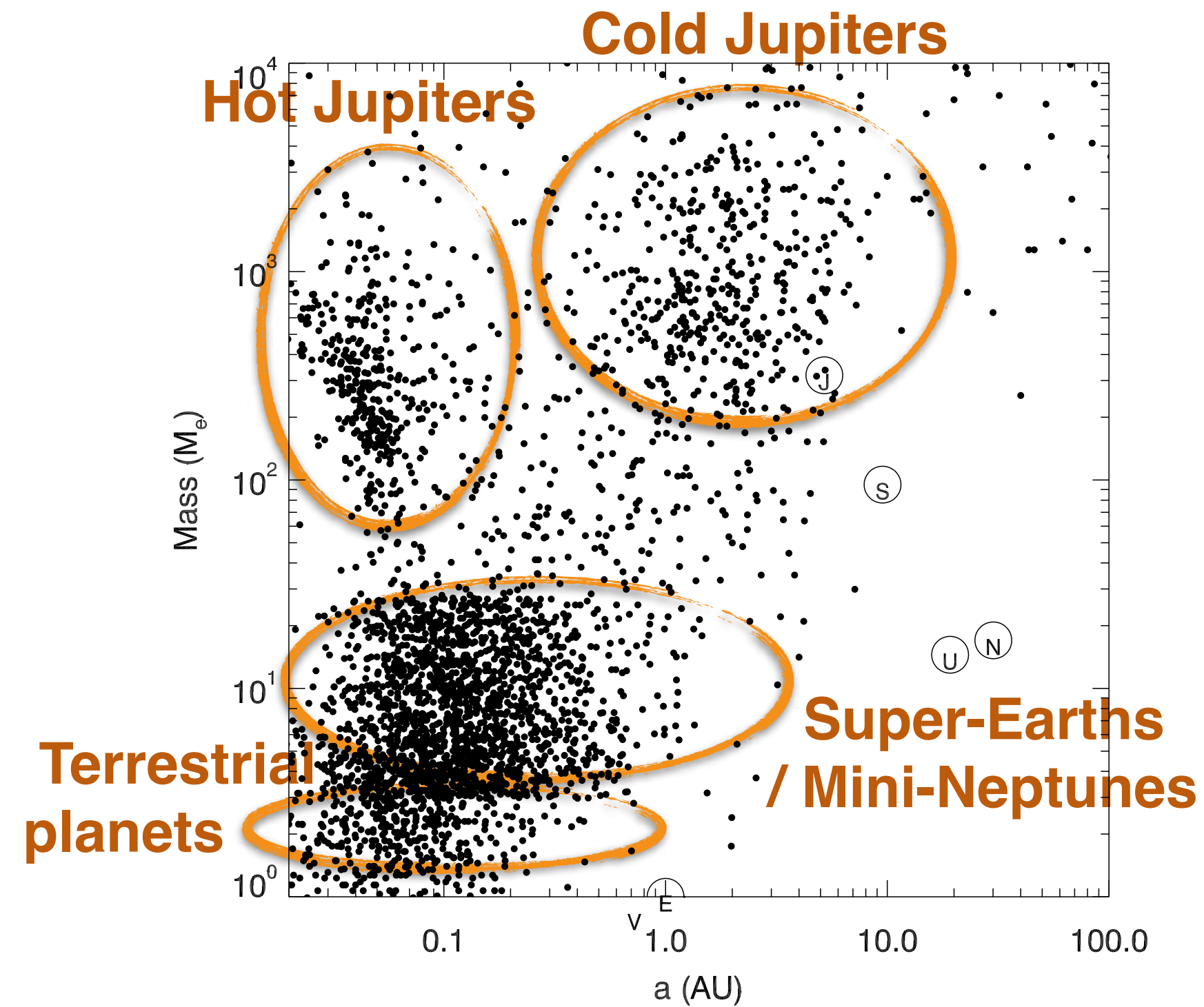


Exoplaneten: de populatie

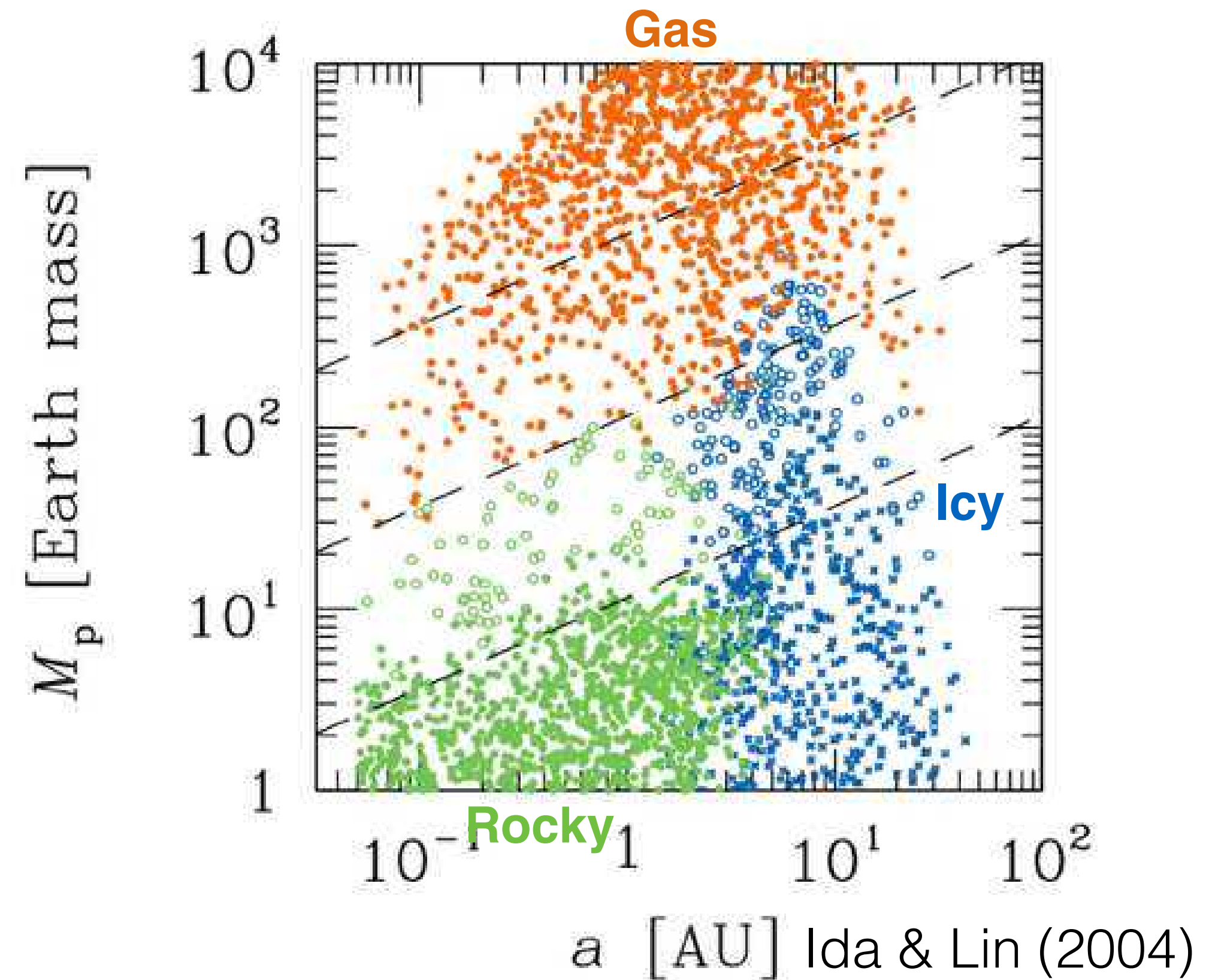


Database exoplaneetwaarnemingen:
dace.unige.ch

Waargenomen



Verwacht



- Hoe uniek is ons zonnestelsel?
- Waarom heeft ons zonnestelsel geen super-aardes?
- Welke rol hebben gasreuzen in de evolutie van planetenstelsels?
- Wat bepaalt de bewoonbaarheid van een exoplaneet?