SPIRou et SPIP

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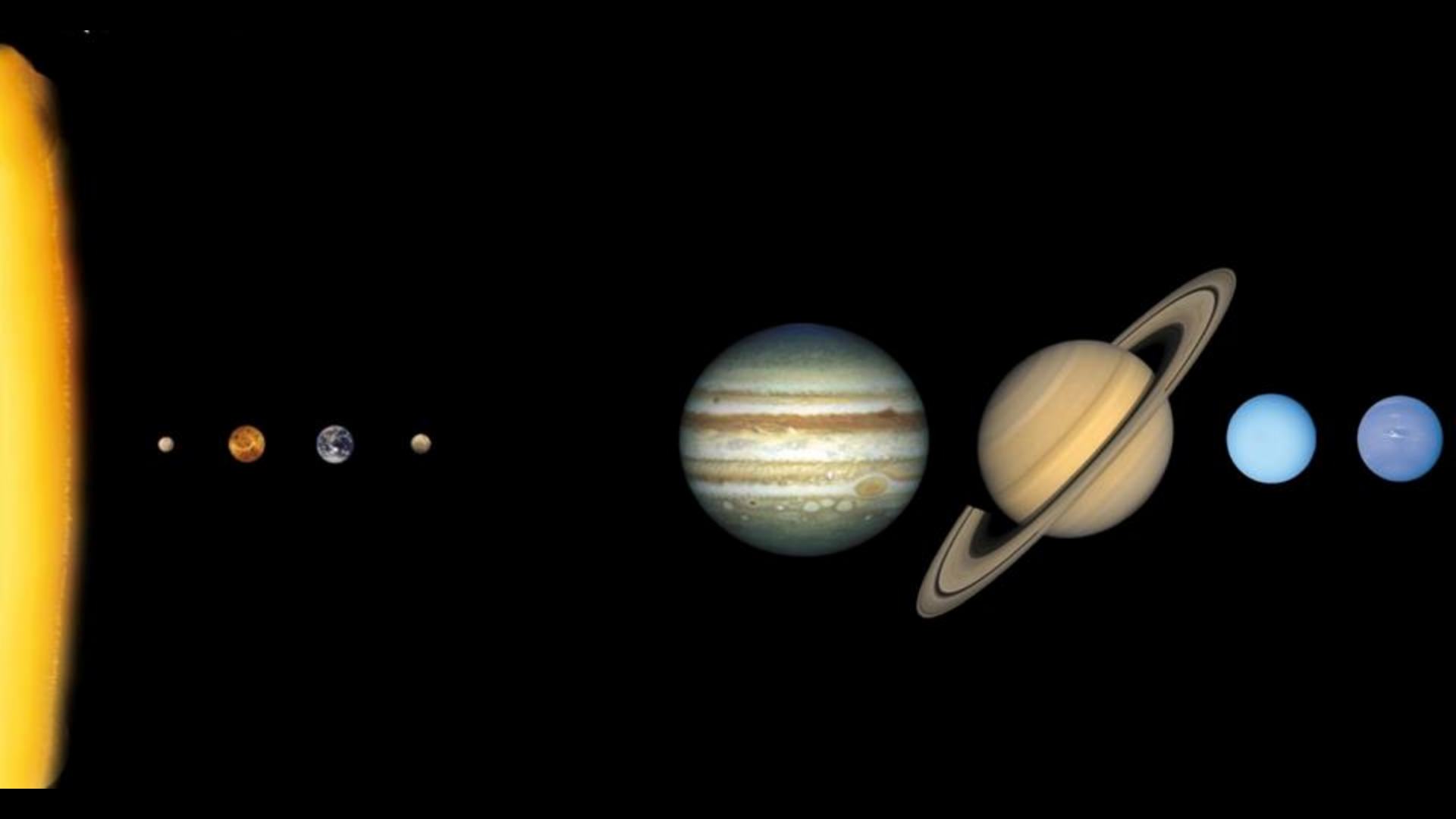
Étoiles et exoplanètes

Institut de Recherche en Astrophysique et Planétologie
Observatoire Midi-Pyrénées

Claire Moutou

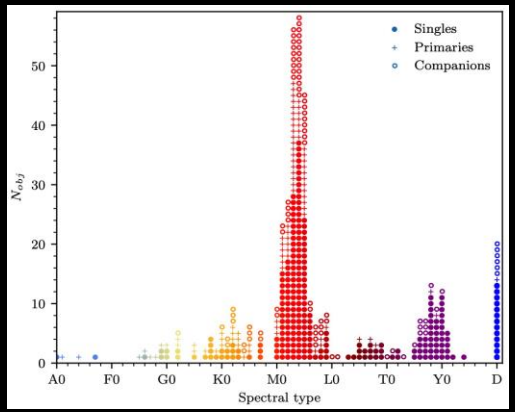
Dessin: Aurore Bouchet, OMP Univ. de Toulouse



Le Soleil dans une Galaxie de 200 milliards de soleils

Les planètes se forment elles autour de tout type d'étoiles?

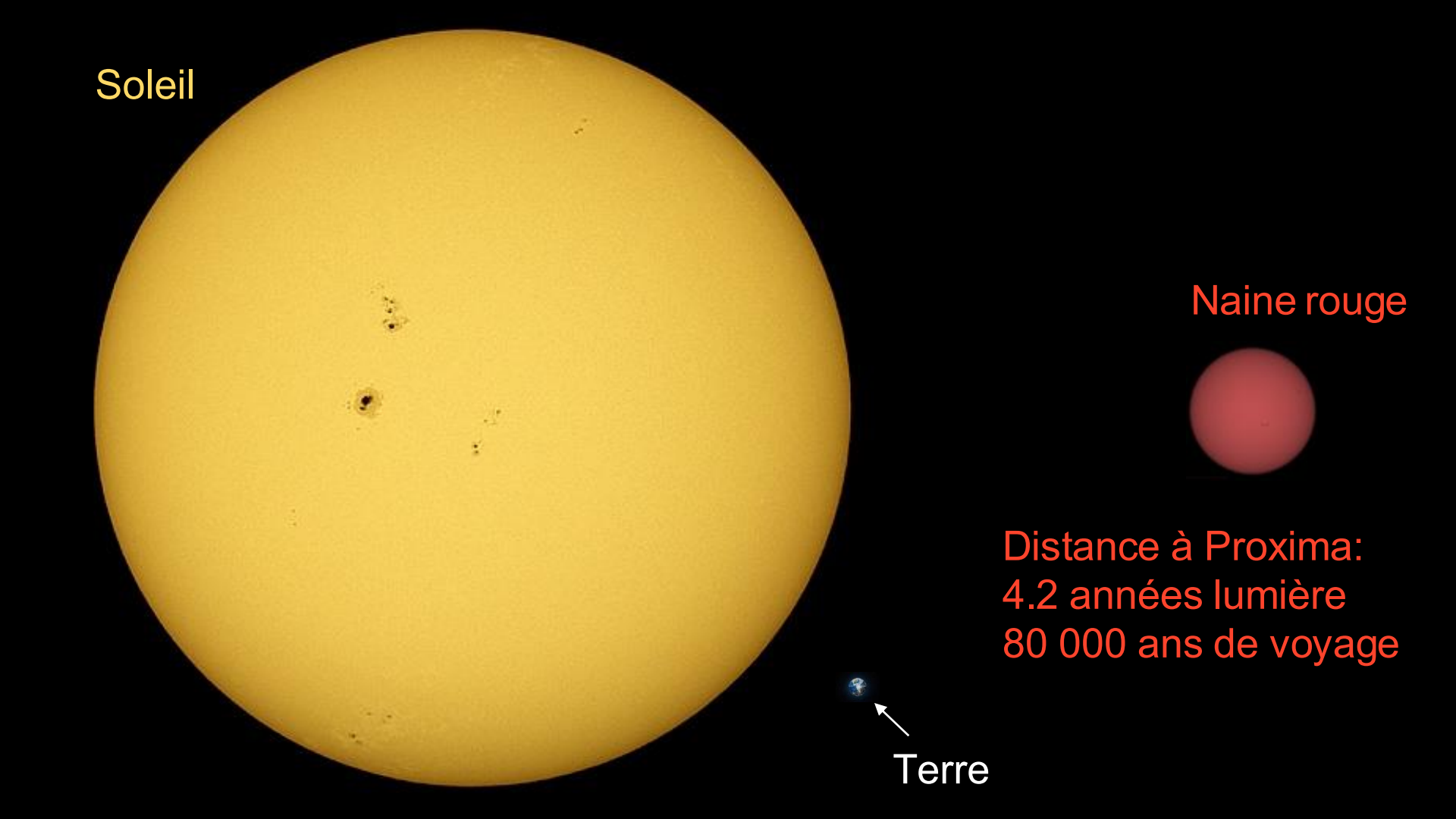
Combien de planètes dans notre Galaxie?

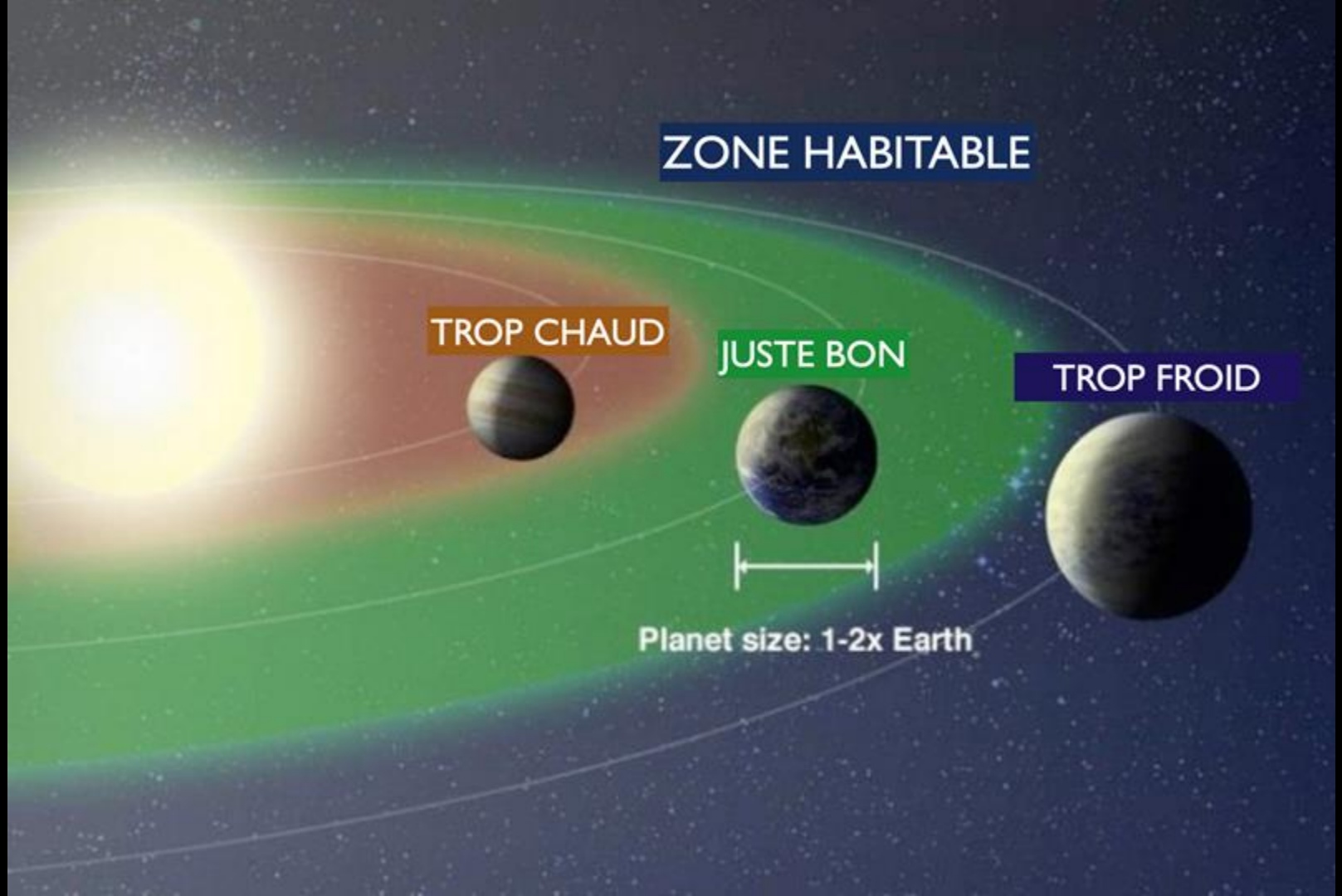


Tous les systèmes ont ils plusieurs planètes? Avec quelle architecture?

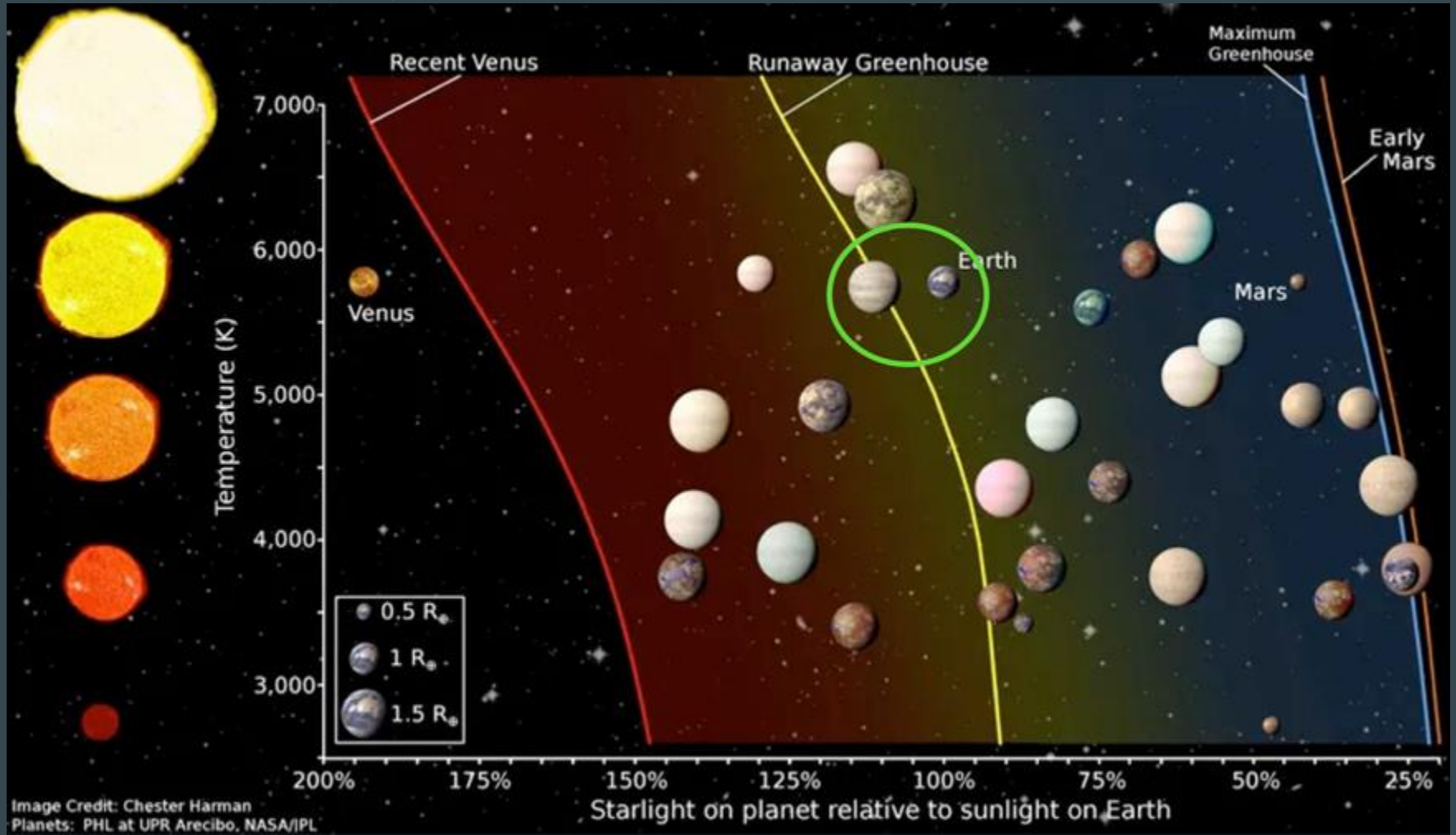
Sun

Est ce que certaines de ces planètes pourraient abriter un système vivant?

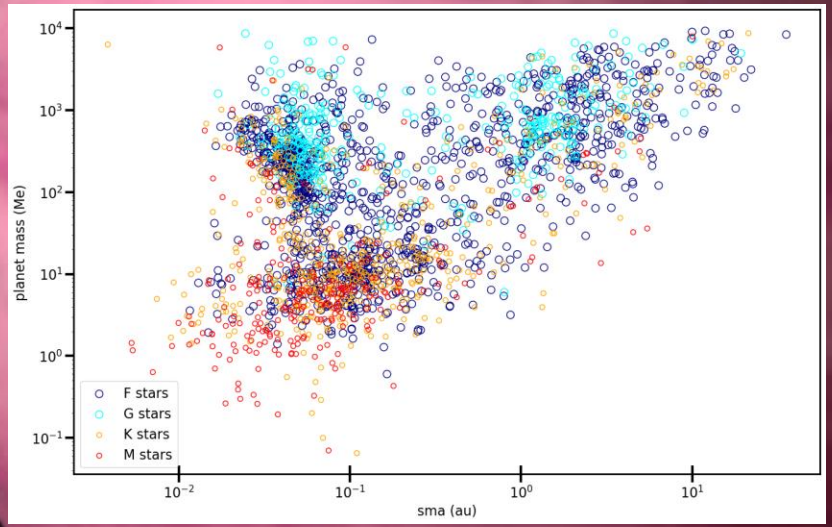

Soleil
Naine rouge
Distance à Proxima:
4.2 années lumière
80 000 ans de voyage
Terre

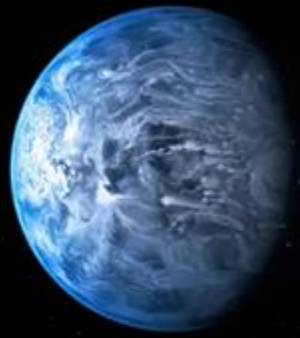

ZONE HABITABLE
TROP CHAUD
JUSTE BON
TROP FROID
Planet size: 1-2x Earth

Des exoplanètes dans la zone habitable de leur étoile



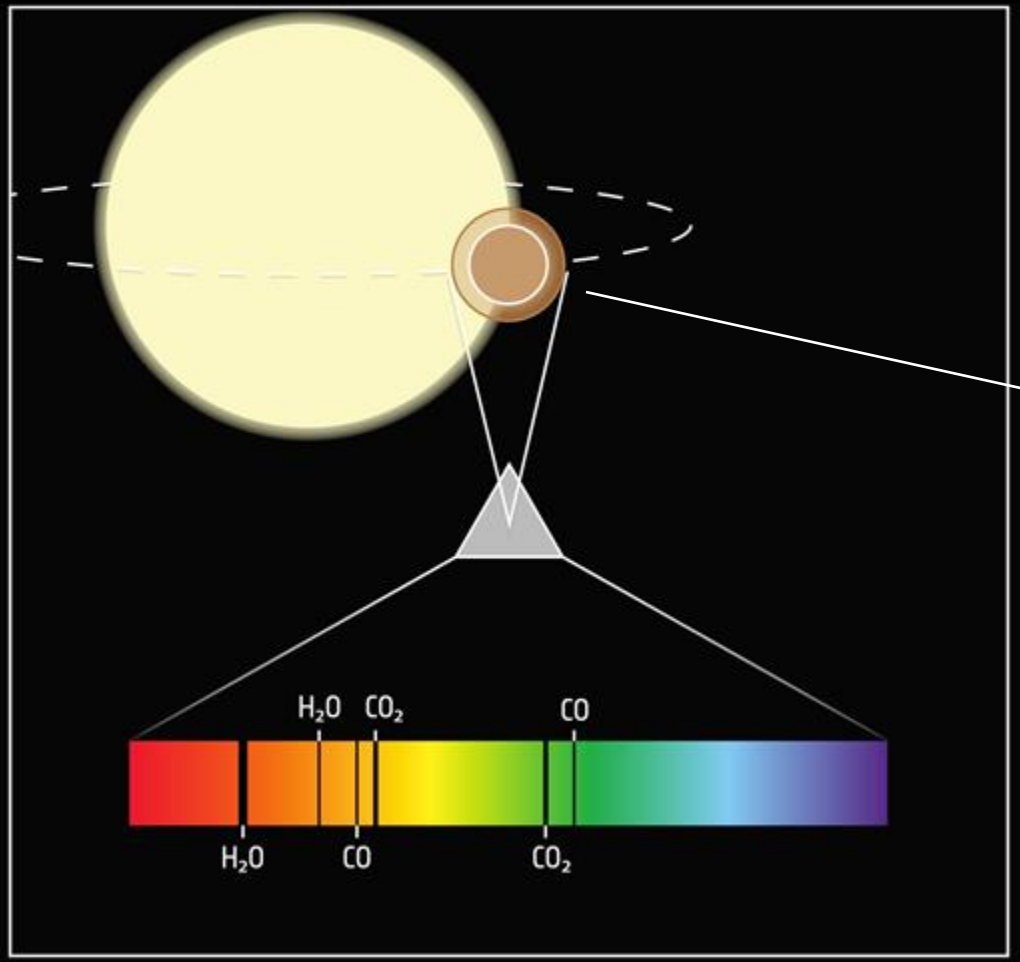
DIVERSITÉ

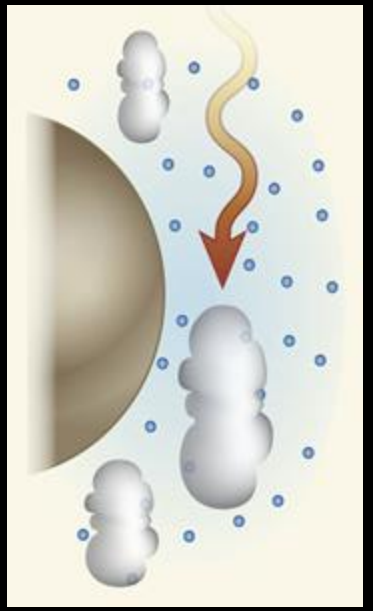




100 milliards de planètes dans la Galaxie

Pour aller plus loin: analyser les atmosphères





2018: Maunakea, Hawai'i

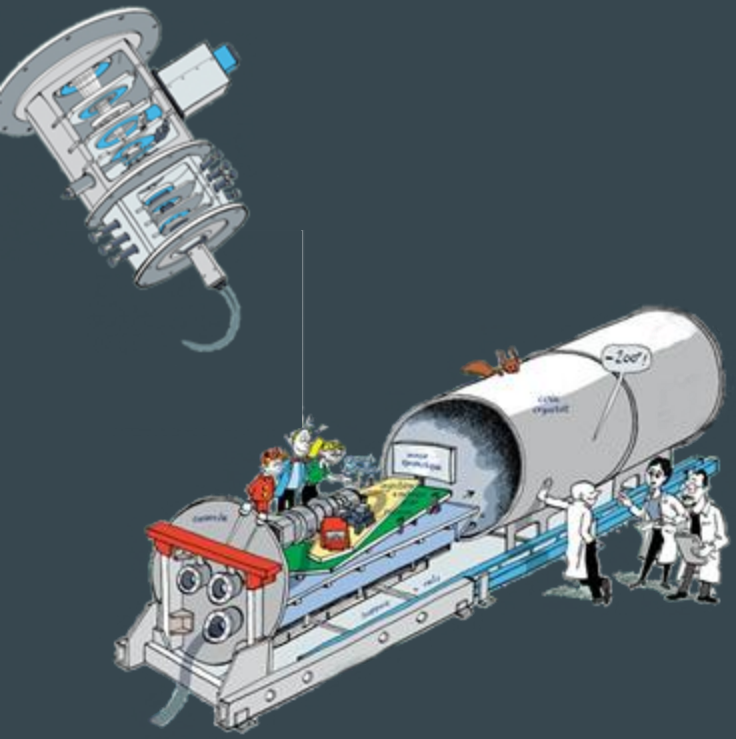
SPiRou

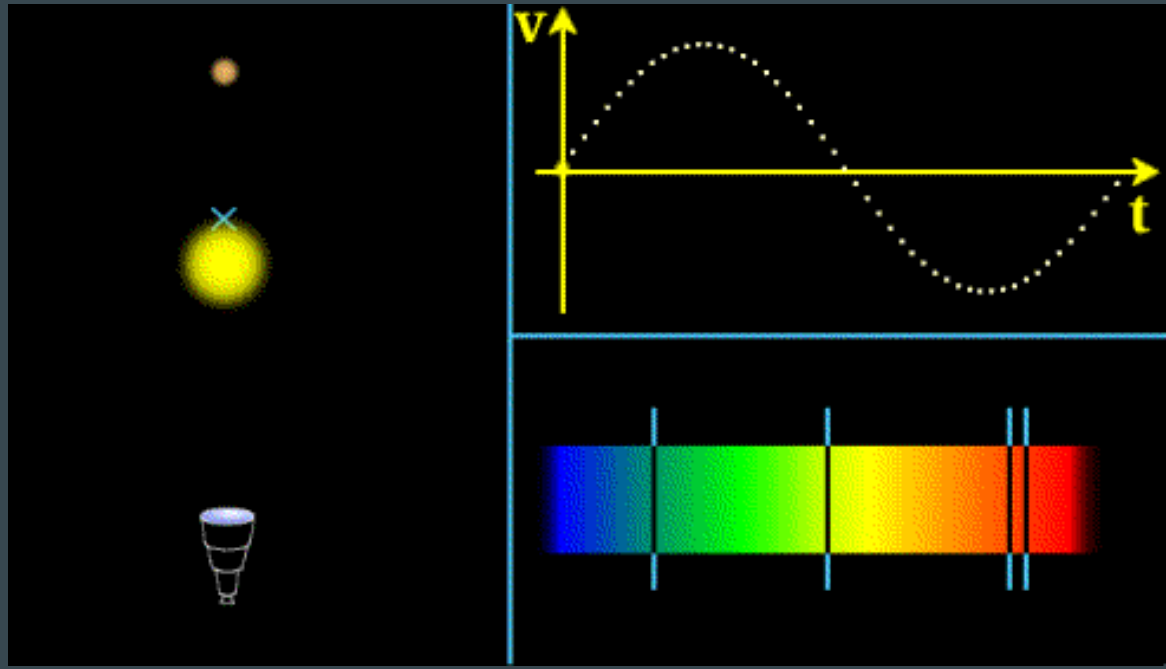
2025: Pic du Midi de Bigorre

SPiP

Photos: J-C Cuillandre, CFHT; P. Charpentier, Univ. de Toulouse

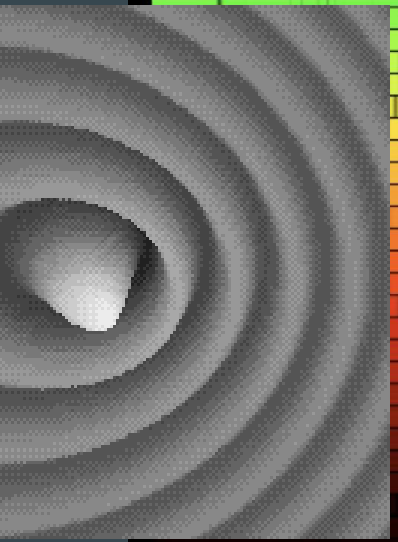
SPIRou et SPIP : exoplanètes, champs magnétiques, atmosphères



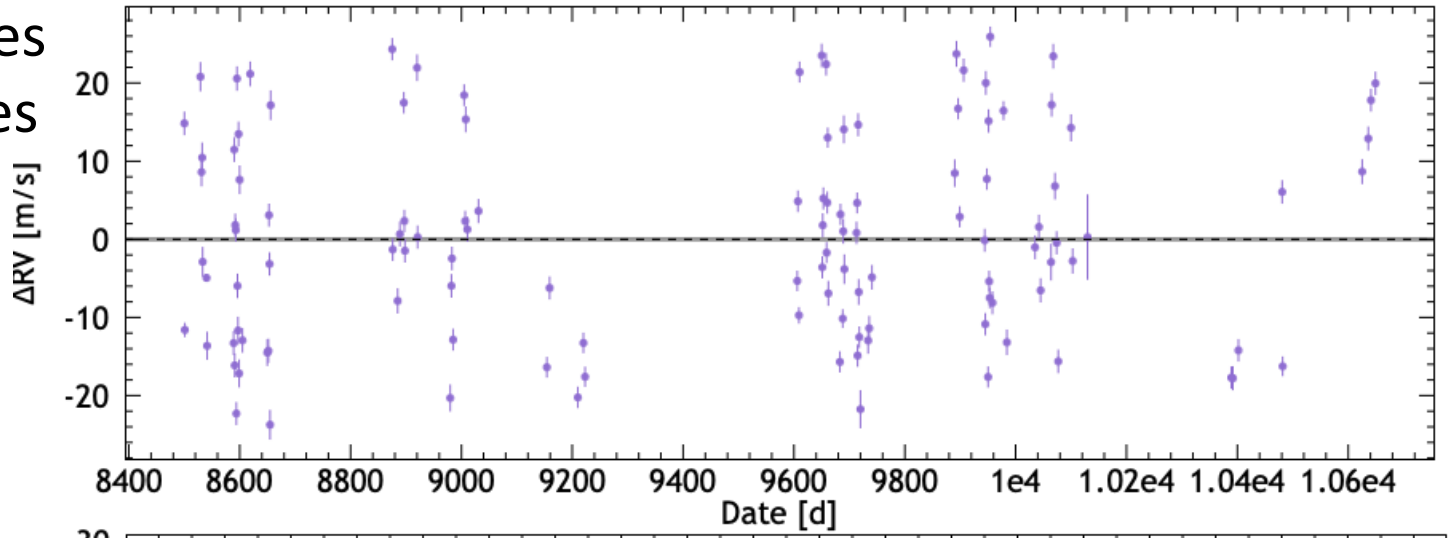


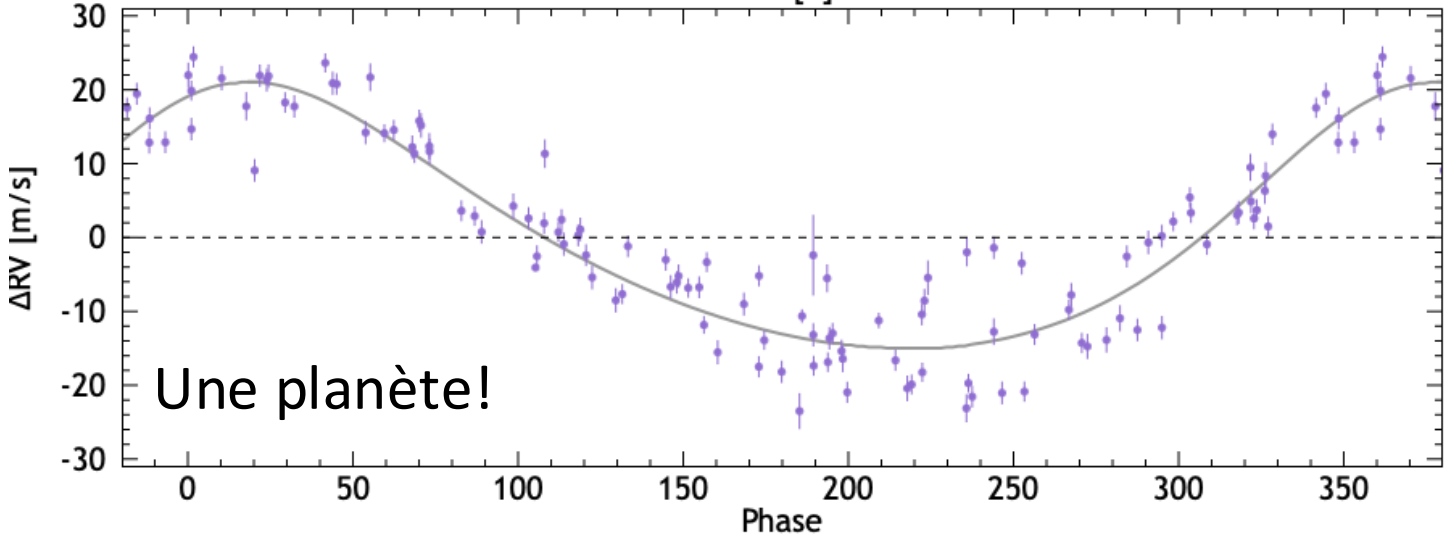
Masse de la planète, distance à l'étoile

Effet Doppler:
propagation des ondes émises par un objet en mouvement

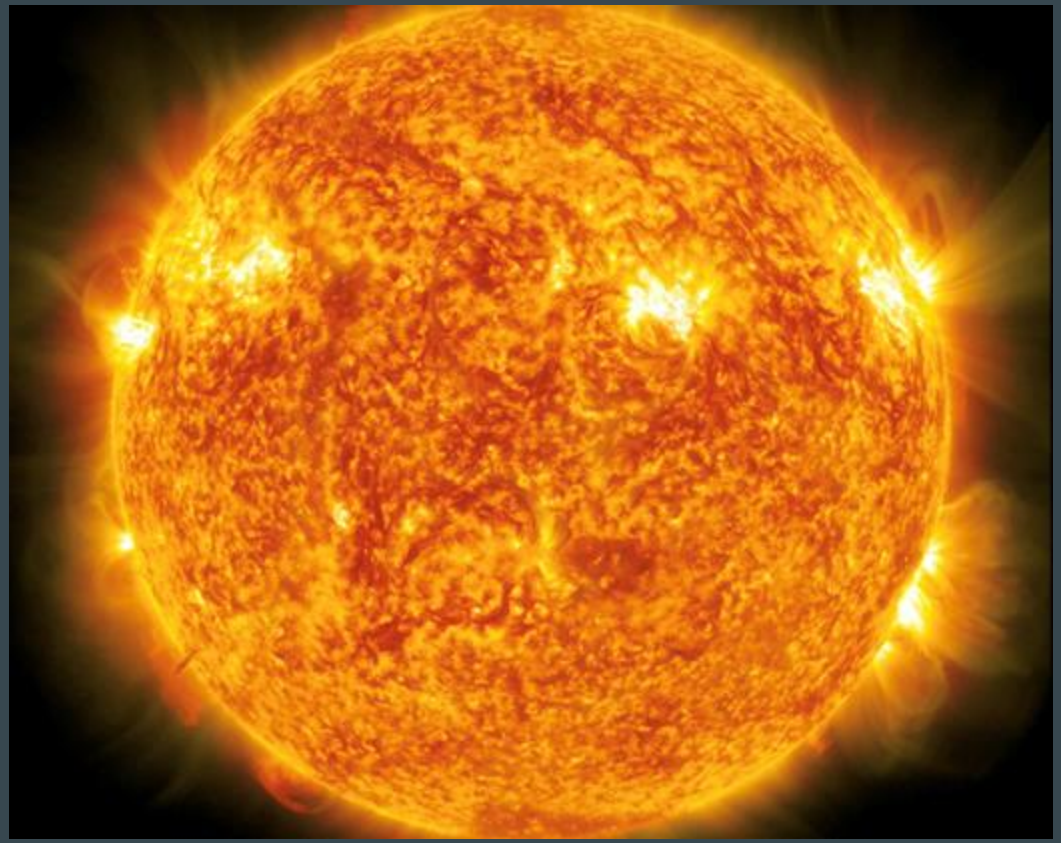


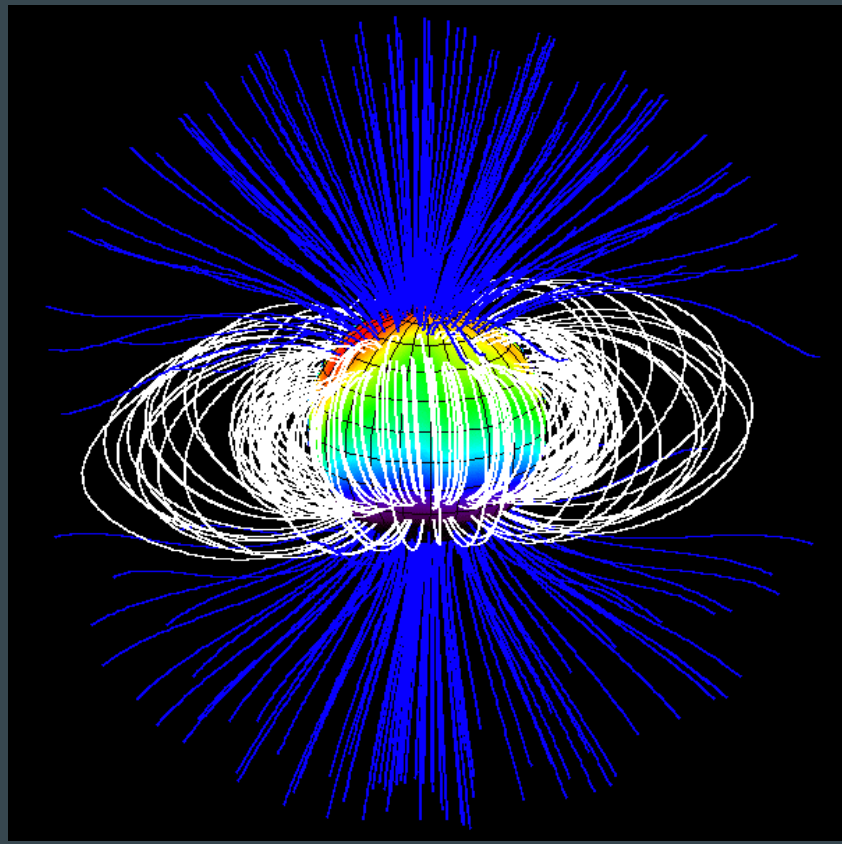
Vitesses radiales

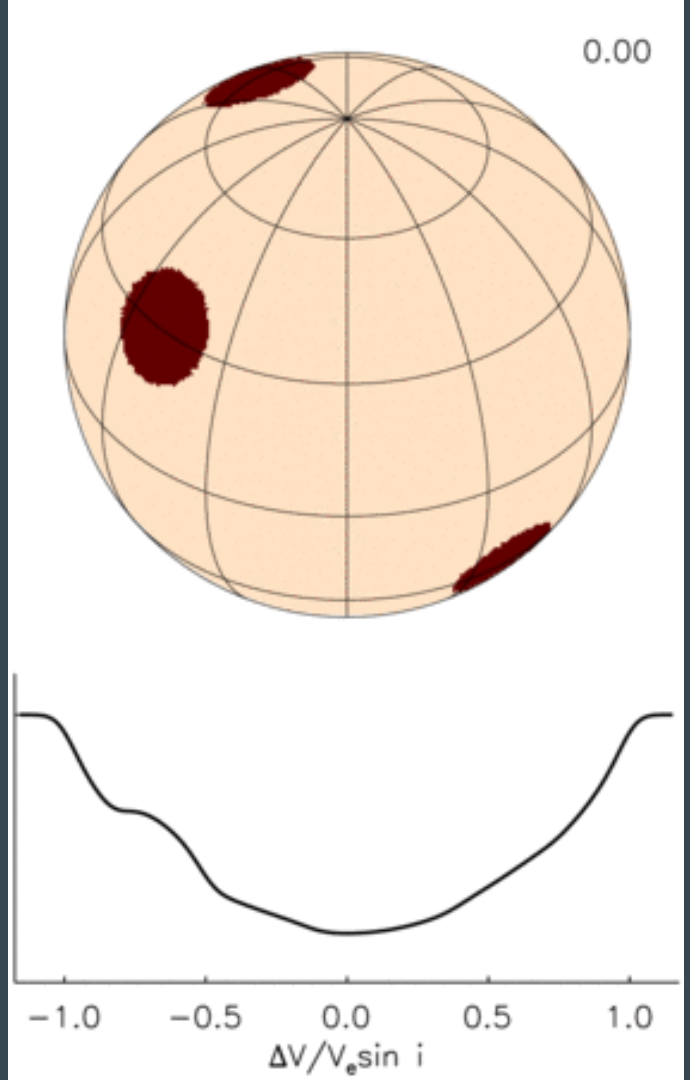


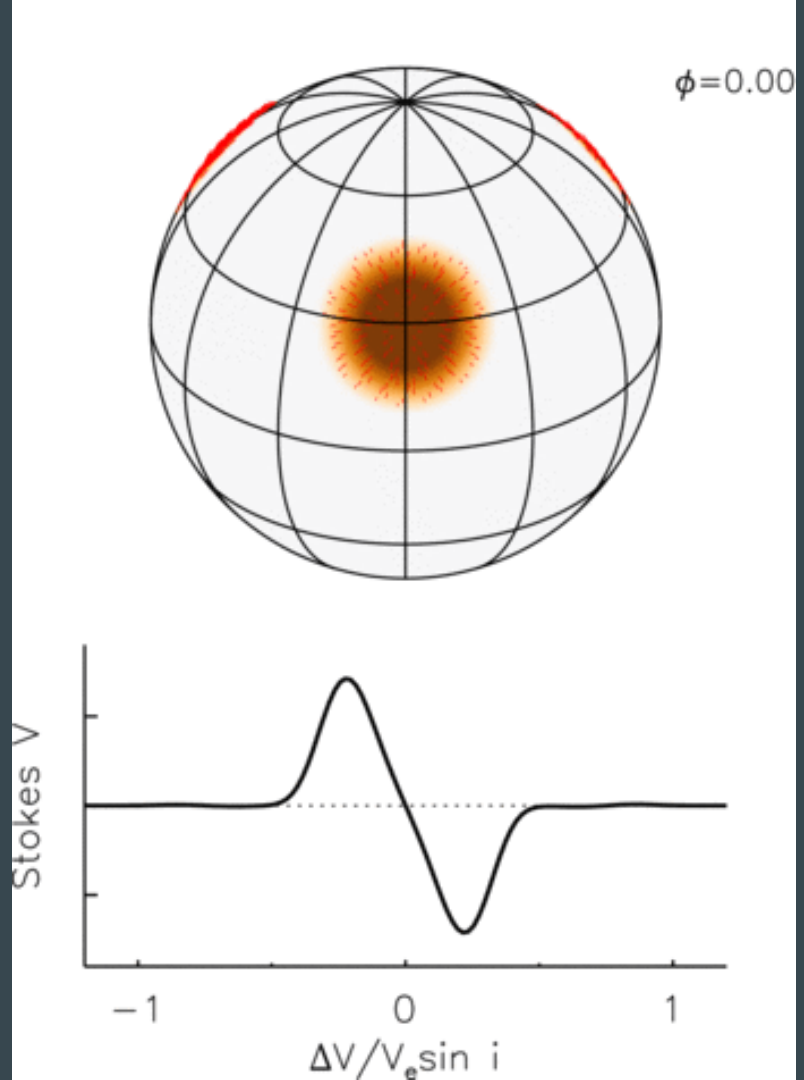


La surface des étoiles est agitée: le champ magnétique

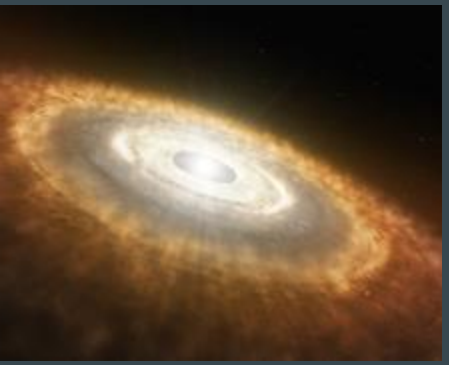





0.00
−1.0
−0.5
0.0
0.5
1.0
ΔV/V$_e$sin i


ϕ=0.00
Stokes V
−1
0
1
ΔV/V$_e$sin i

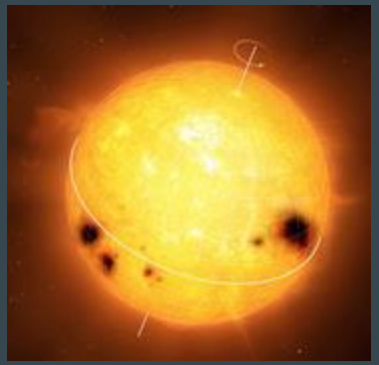
Palmarès SPIRou depuis 2019



60 étoiles très jeunes

100 étoiles évoluées

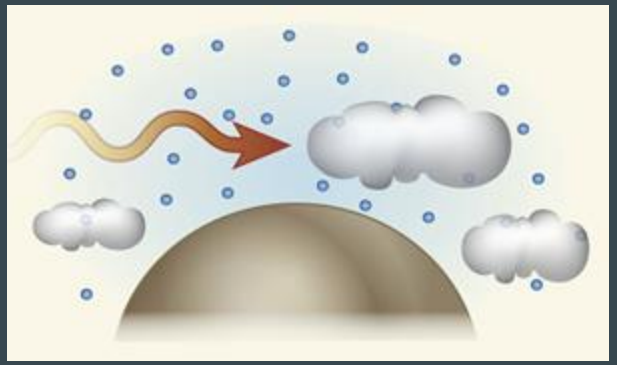
Naissance et évolution de leur champ magnétique



10 exoplanètes

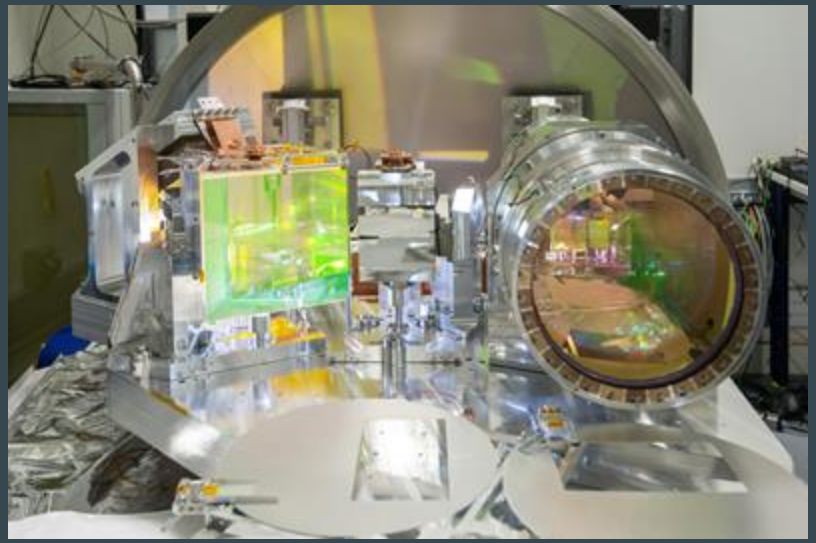
Systèmes multiples

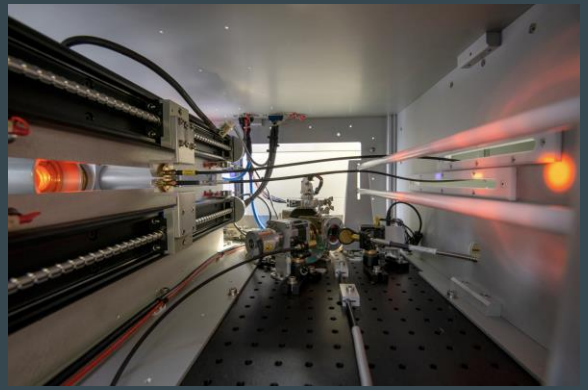
Les super-Terres habitables voisines



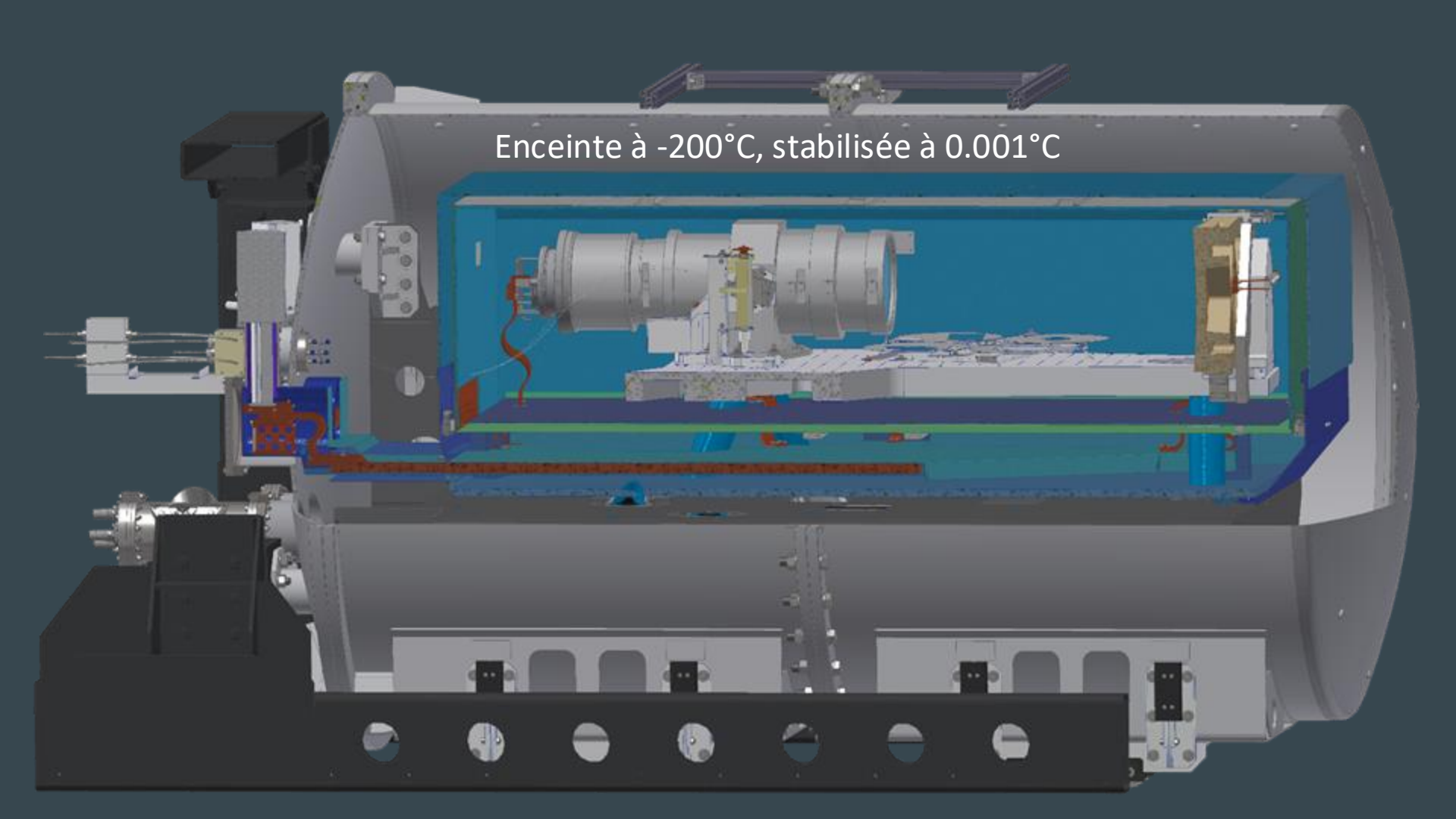
Les molécules fondamentales des planètes géantes et leurs vents : H_2O, CO

A venir: campagnes d'observations conjointes SPIRou/SPIP

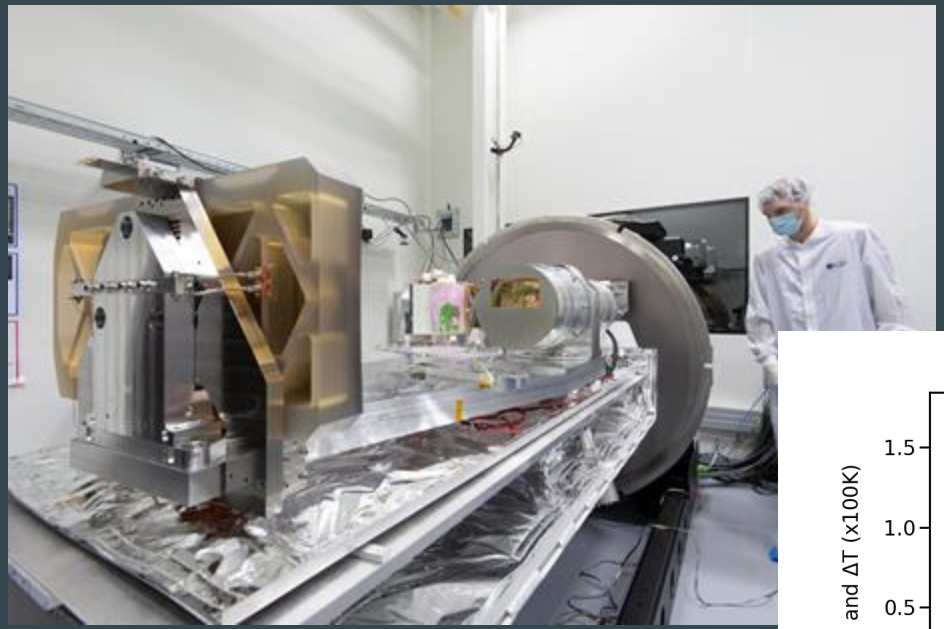


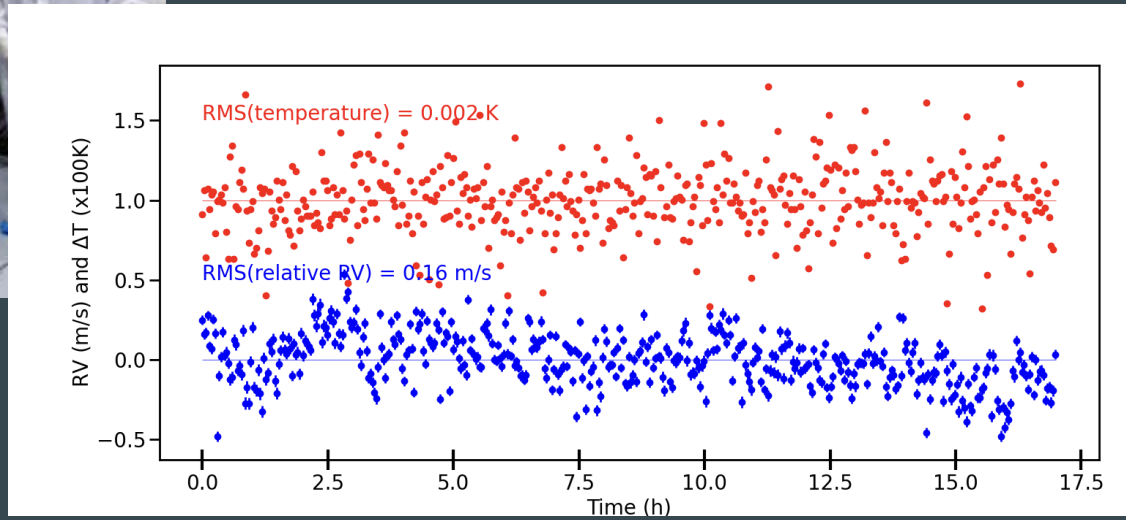


Photos: S. Chastanet, OMP


Enceinte à -200°C, stabilisée à 0.001°C

Assemblage et tests à Toulouse, IRAP/OMP 2023-2025



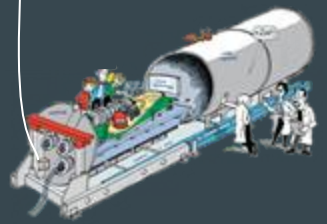


Photos: S. Chastanet, OMP

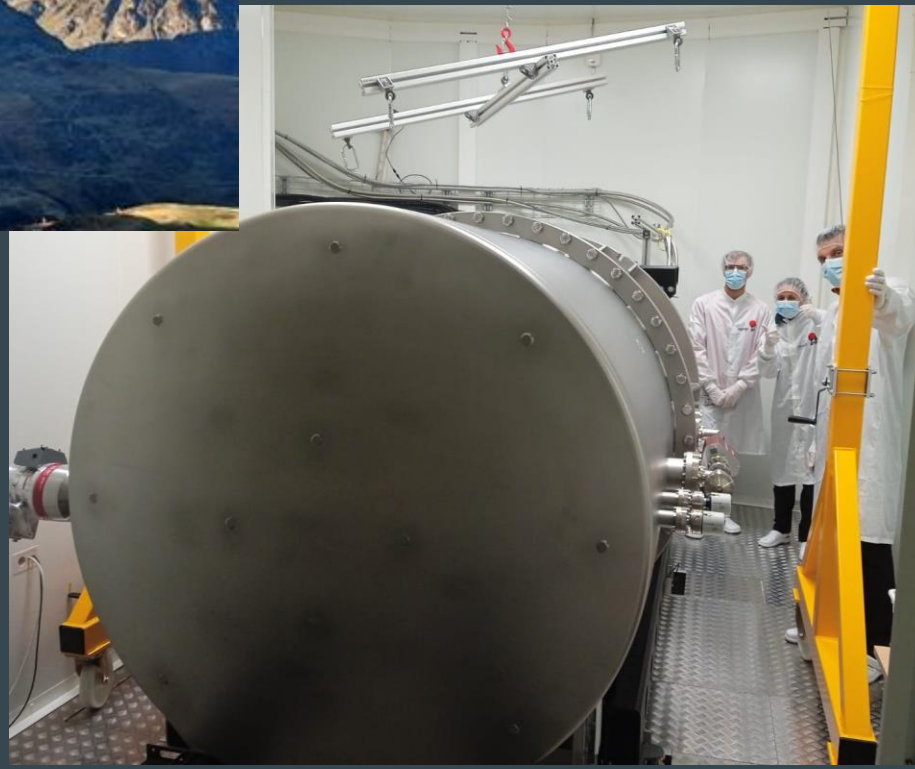
Août 2025
Photo: M. Lacombe, OMP

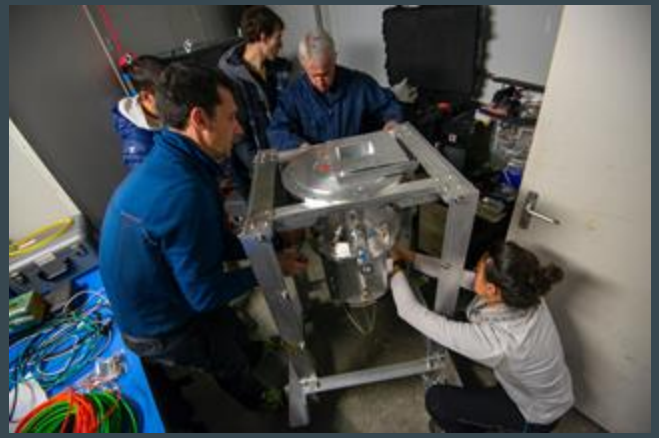
Arrivée au Pic du Midi:
octobre 2025

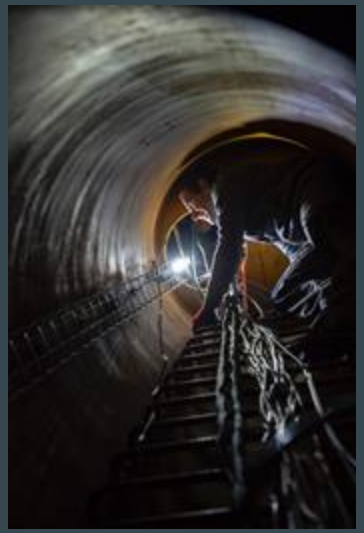
45m



octobre 2025

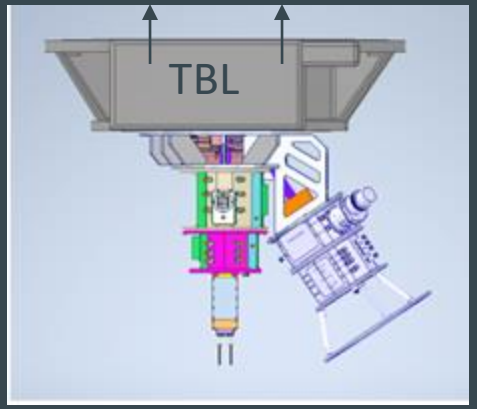


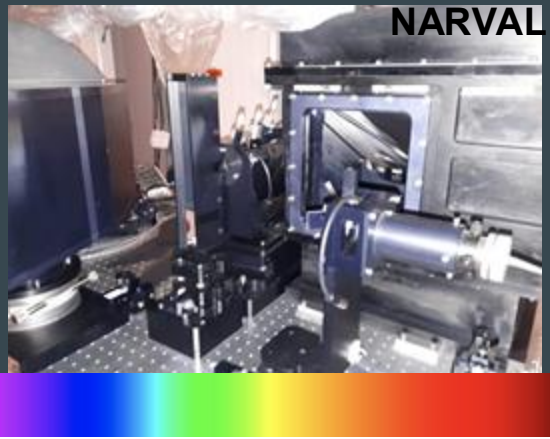




Première lumière début 2026… observations scientifiques à partir de fin 2026

A venir… VISION: un arc-en-ciel géant de l'UV à l'infrarouge





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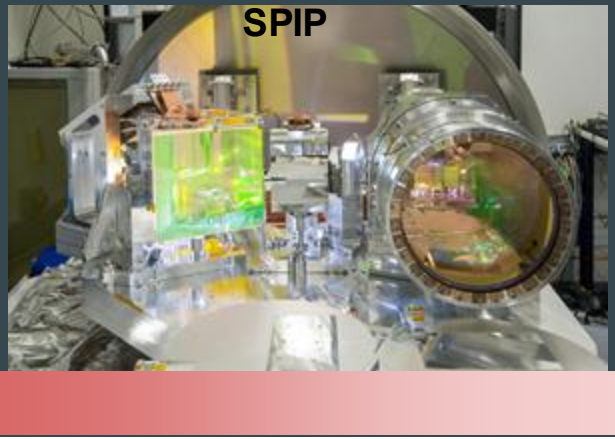

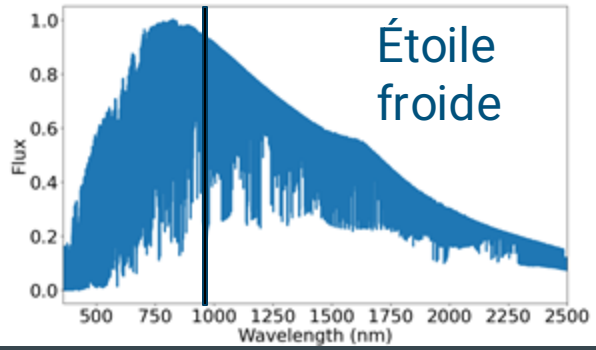

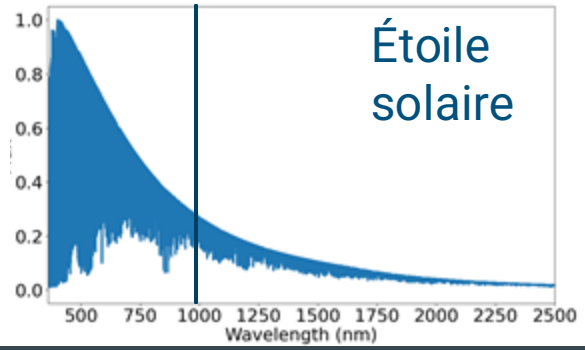

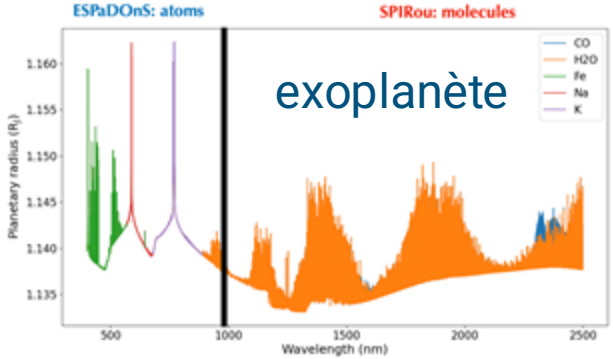

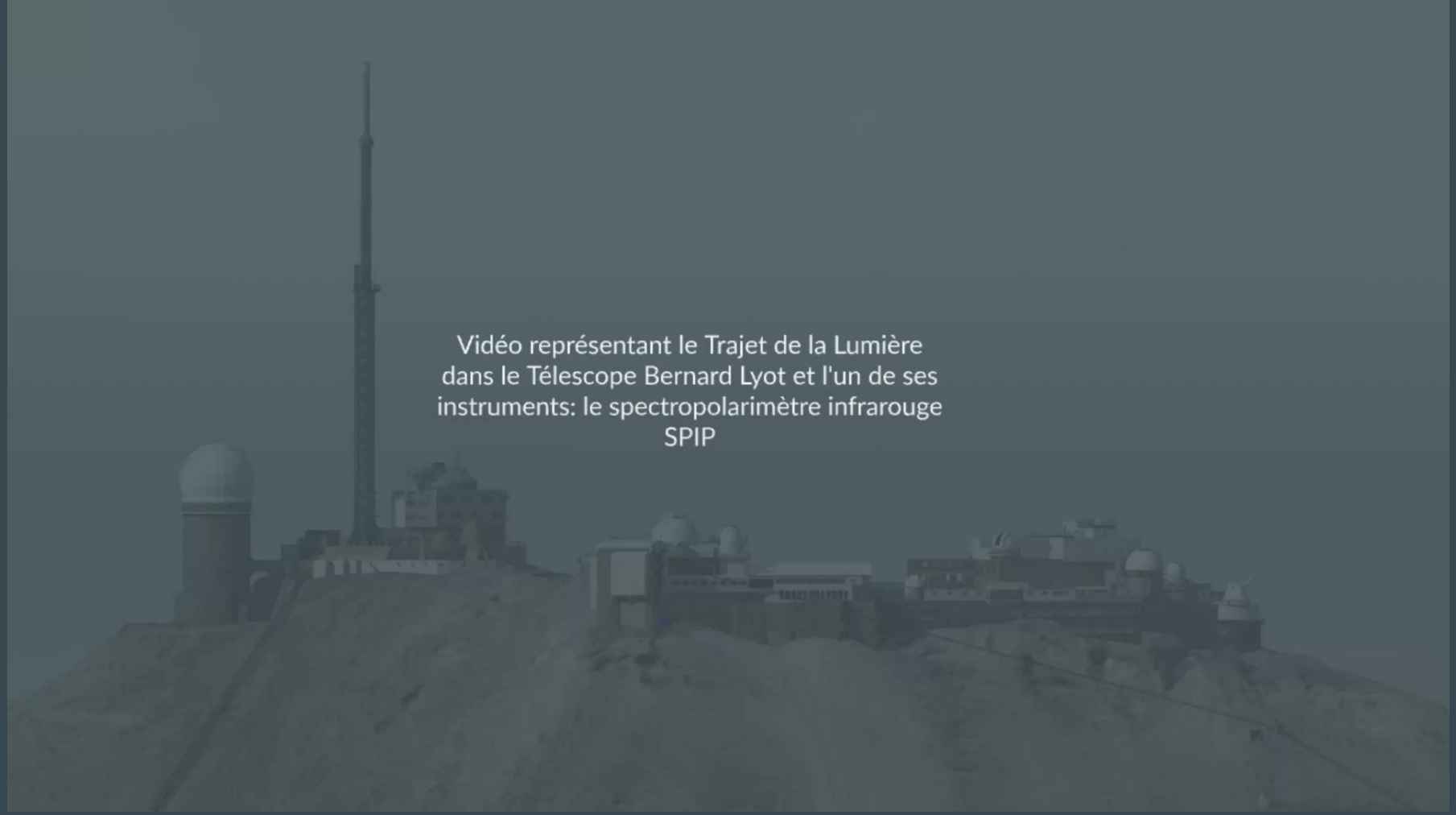

Vidéo: C. Montheil, Univ. de Toulouse, OMP