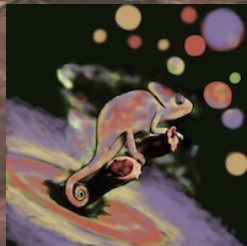


Rocky exoplanets

Beatriz Campos Estrada, CHAMELEON Marie Curie PhD Fellow

Centre for ExoLife Sciences, Niels Bohr Institute

Space Research Institute, Austrian Academy of Sciences



ÖAW



WHERE HAVE I BEEN, WHERE AM I AND WHERE WILL I BE?



MSci Physics at Imperial College London (2016-2020)

- 3rd year project: Testing exoplanet evaporation with multi-transiting systems (Owen & Campos Estrada, 2020)
- MSci thesis: Modelling dusty-tails of evaporating exoplanets (Campos Estrada et al., in prep)

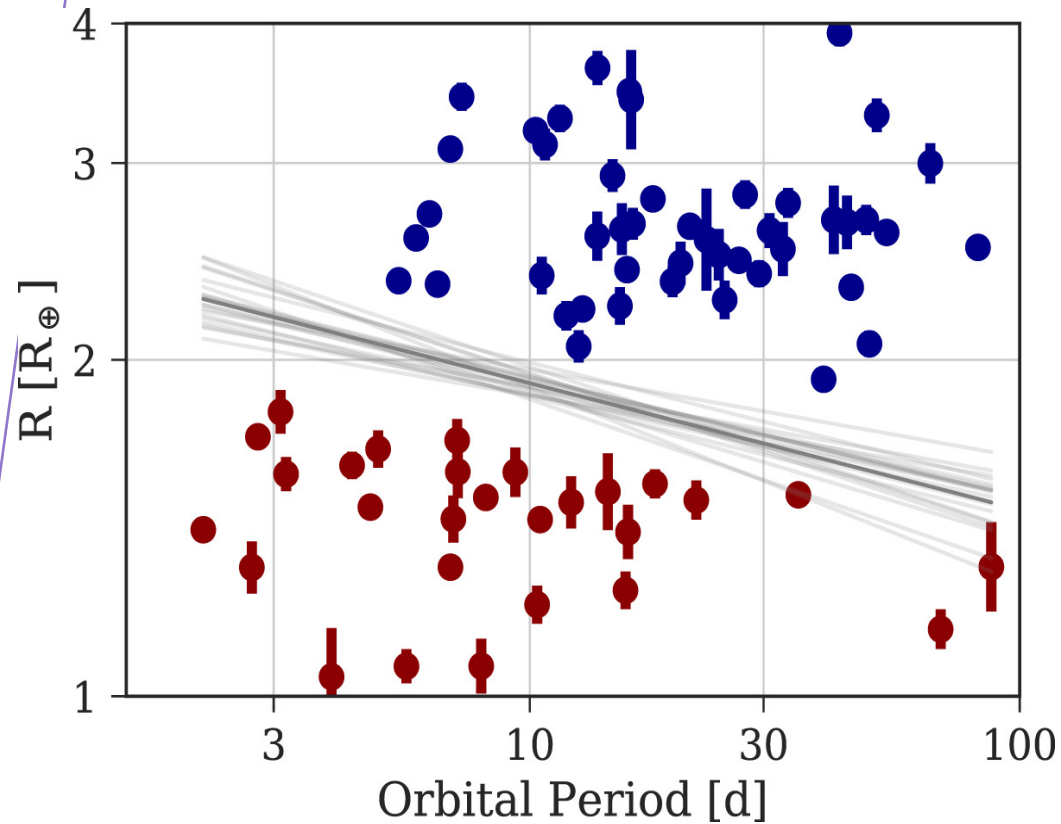
Marie-Curie PhD fellow in Astrophysics and Planetary Science (2020-2024)

- September '20 – March '23: Niels Bohr Institute, University of Copenhagen
- March '23 – August '24: Austrian Academy of Sciences

RESEARCH INTERESTS

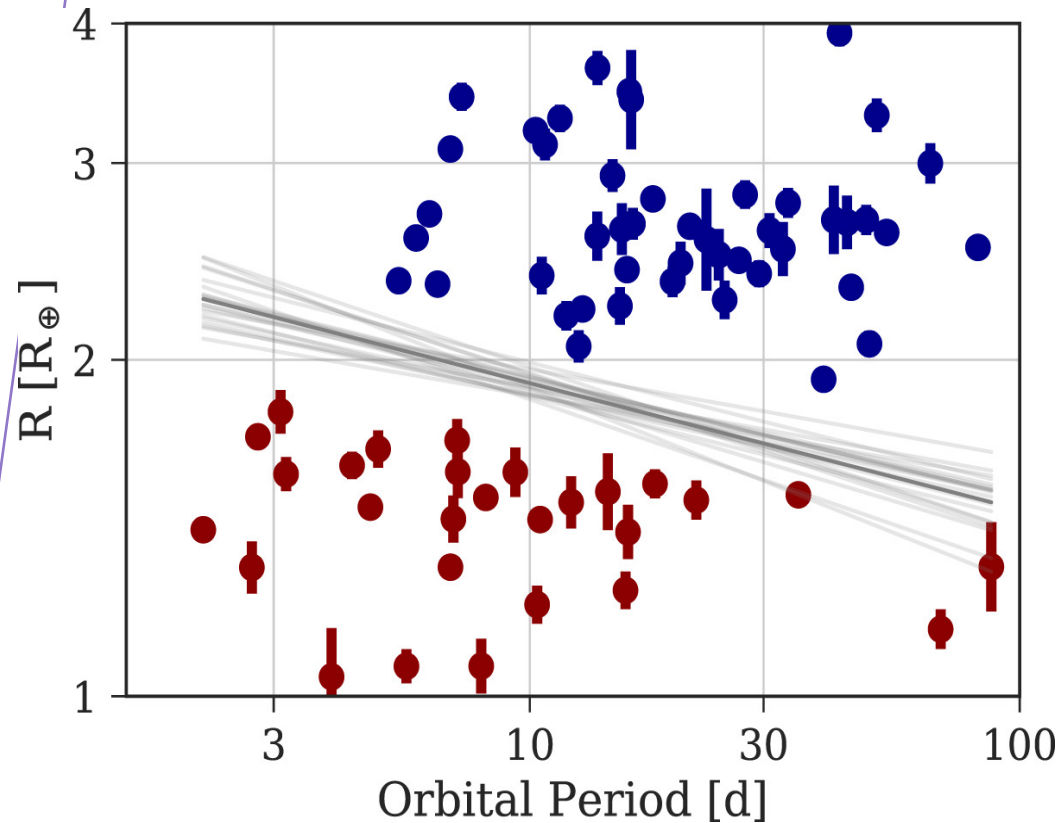
- Exoplanetary populations and formation;
- Probing (exo)planetary compositions;
- Modelling (exo)planetary atmospheres;

EXPLORING THE ORIGIN OF THE RADIUS VALLEY



Van Eylen et al (2018)

EXPLORING THE ORIGIN OF THE RADIUS VALLEY

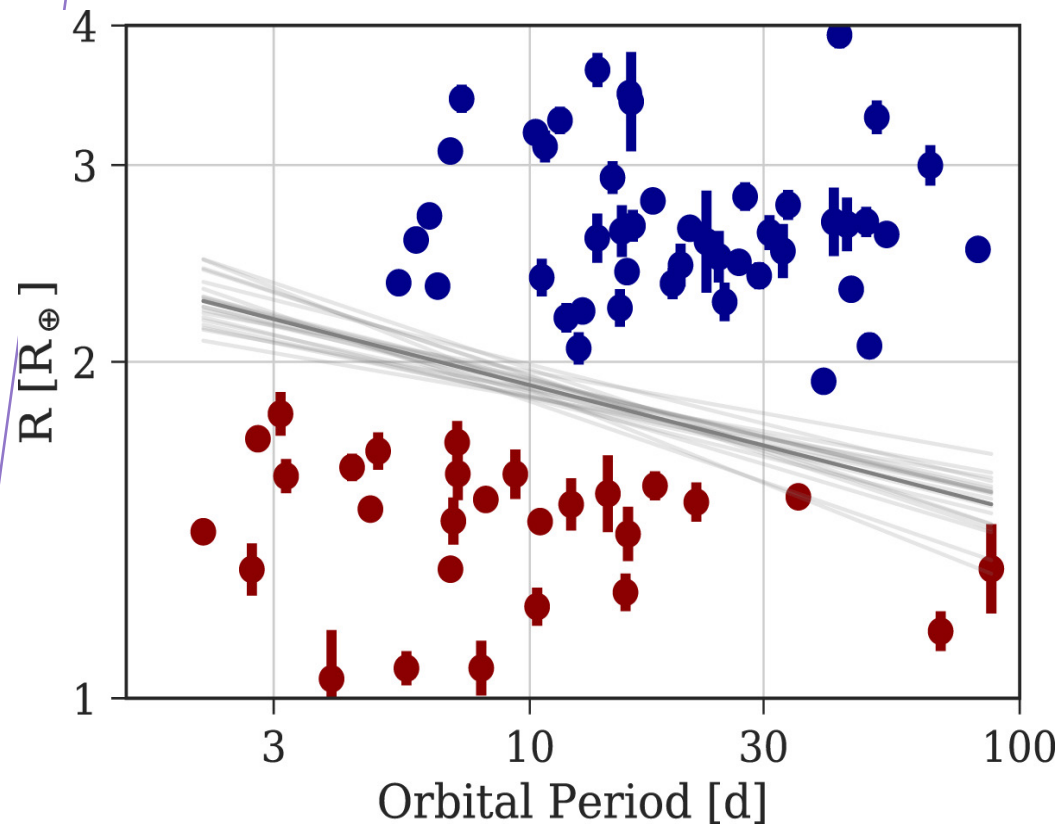


Van Eylen et al (2018)

Two possible origins:

1. Photoevaporation;
2. Core-powered mass-loss;

EXPLORING THE ORIGIN OF THE RADIUS VALLEY



Van Eylen et al (2018)

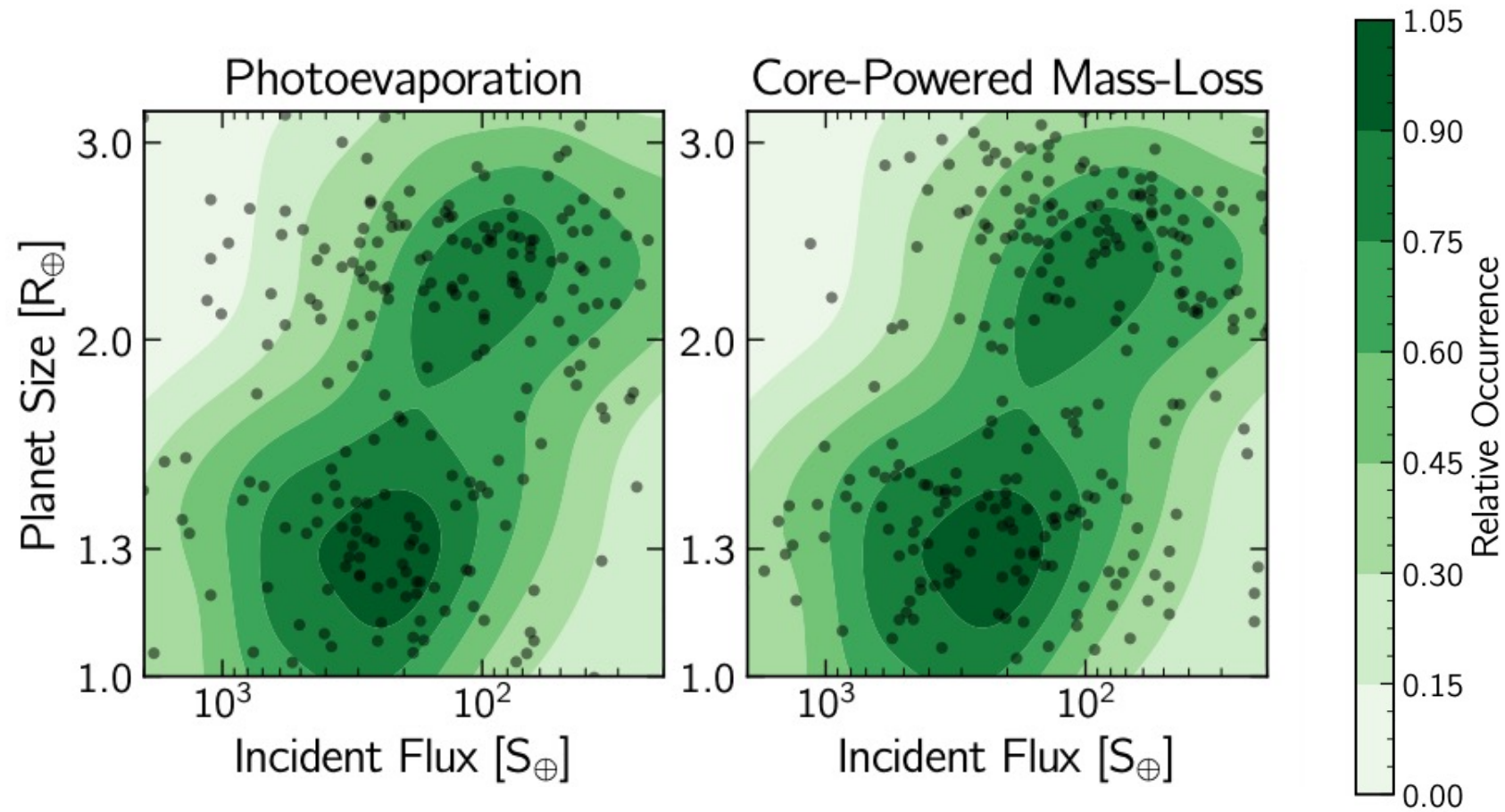
Two possible origins:

1. Photoevaporation;
2. Core-powered mass-loss;

Tested photoevaporation for multistars:

Owen & Campos Estrada, 2020

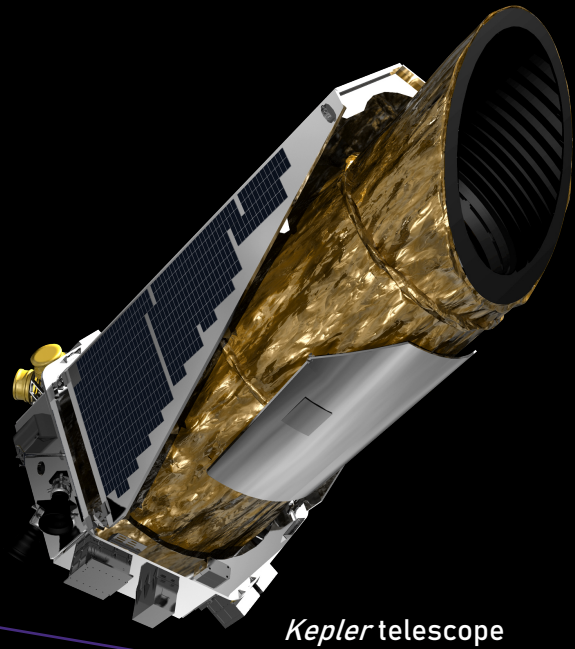
EXPLORING THE ORIGIN OF THE RADIUS VALLEY



Rogers et al. (2021)

HOW DOES THE SURFACE-ATMOSPHERE INTERACTION ALTER THE ATMOSPHERIC STRUCTURE IN ROCKY EXOPLANETS?

DETECTING EXOPLANETS: THE TRANSIT METHOD



Brightness

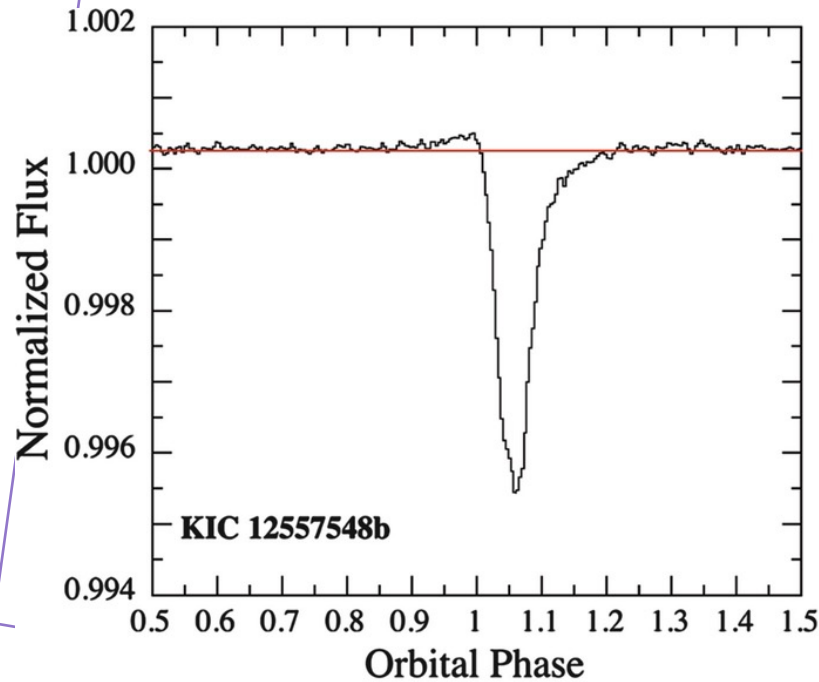
Time

3 Ultra-Short–Period planets with weird light-curves discovered between 2012 and 2015

KIC 12557548b

Discovered by Rappaport et al. (2012)

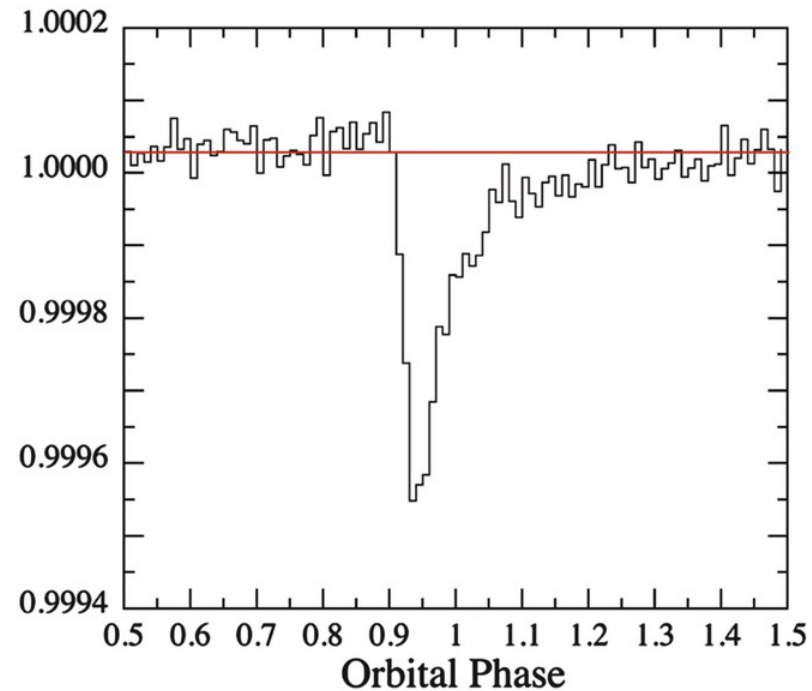
Orbital period of 15.7 hours



KOI 2700b

Discovered by Rappaport et al. (2014)

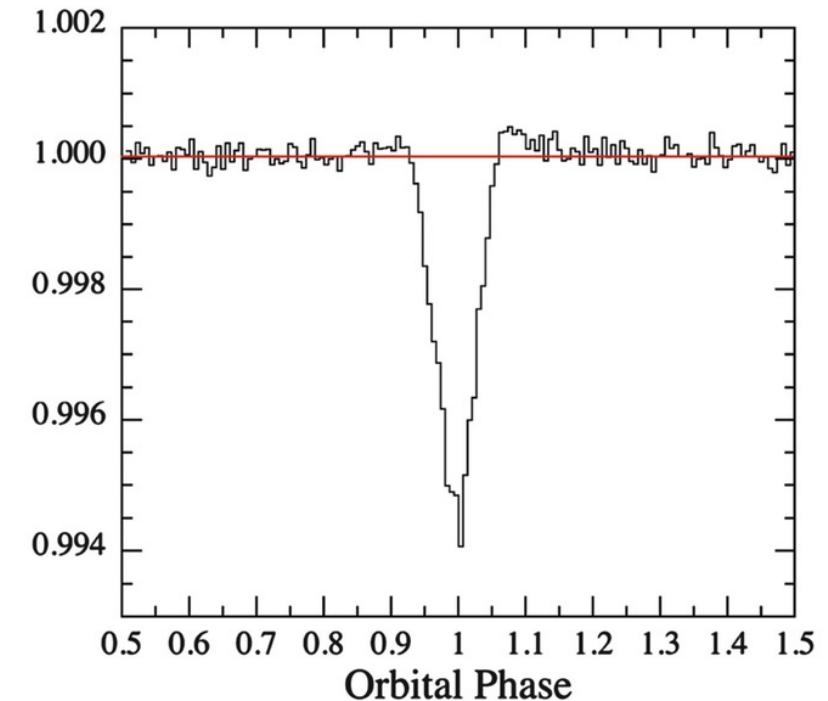
Orbital period of 22.0 hours



K2 22b

Discovered by Sanchis-Ojeda et al. (2015)

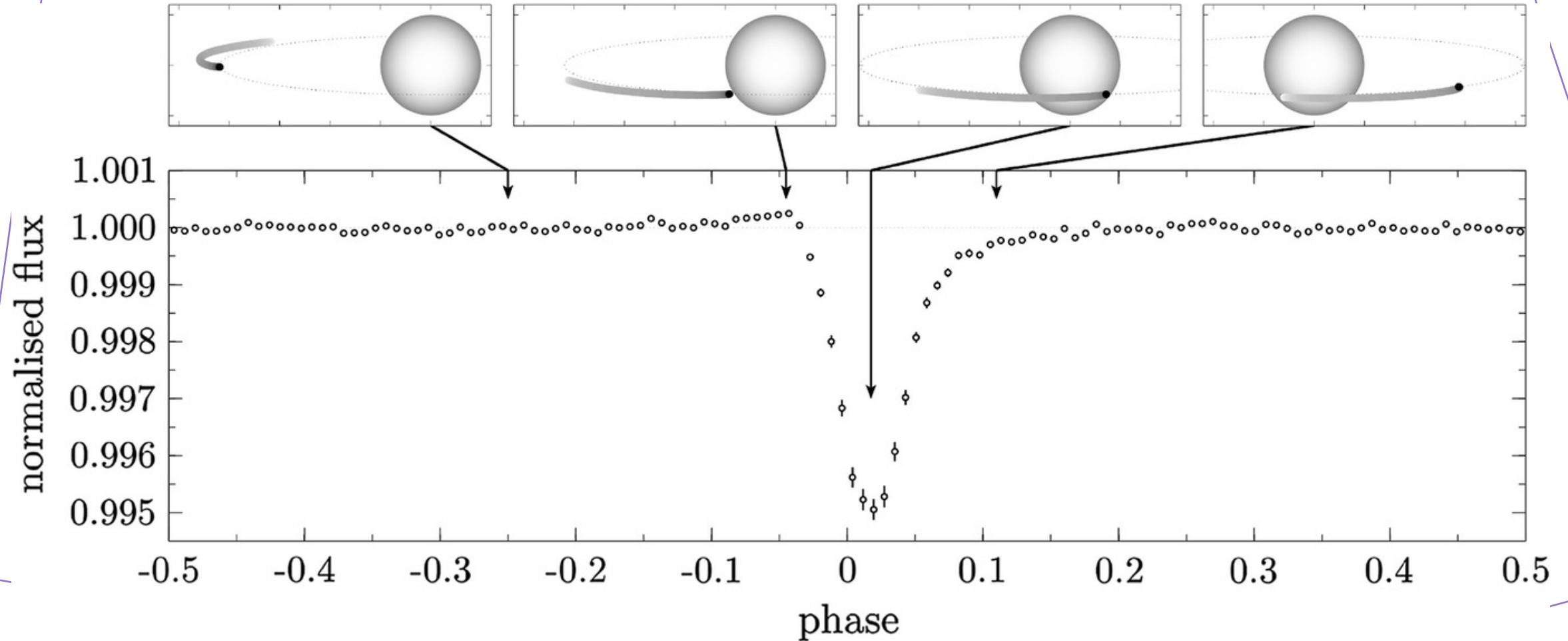
Orbital period of 9.5 hours



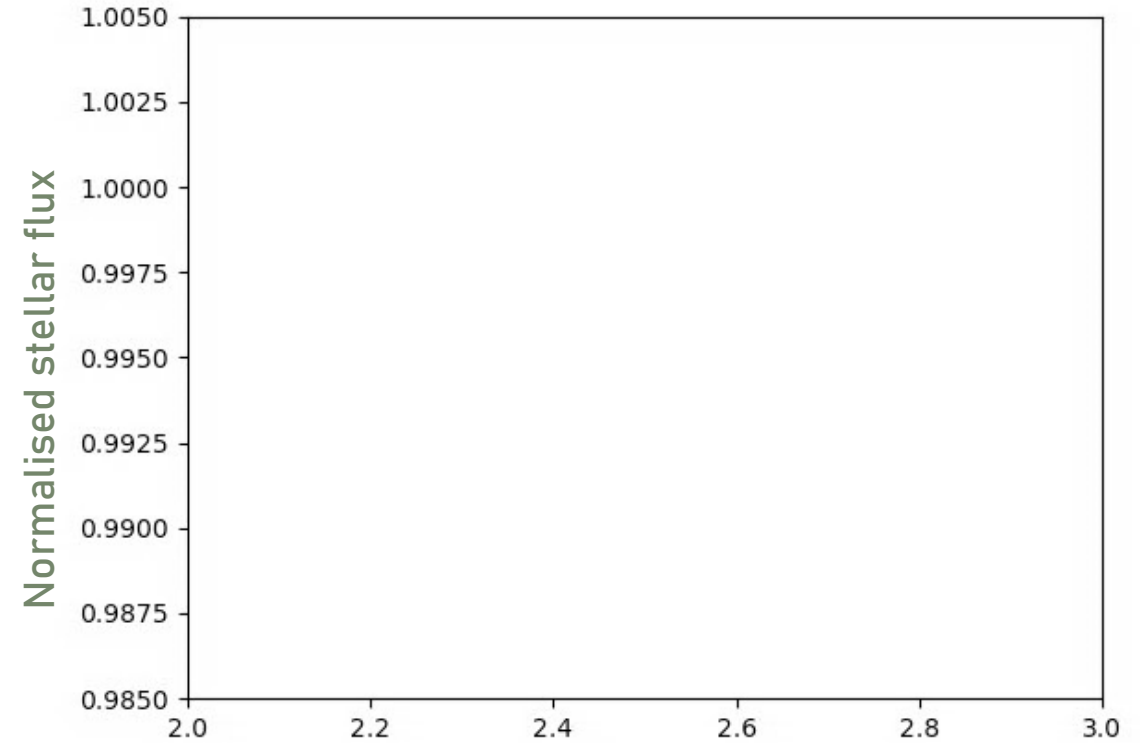
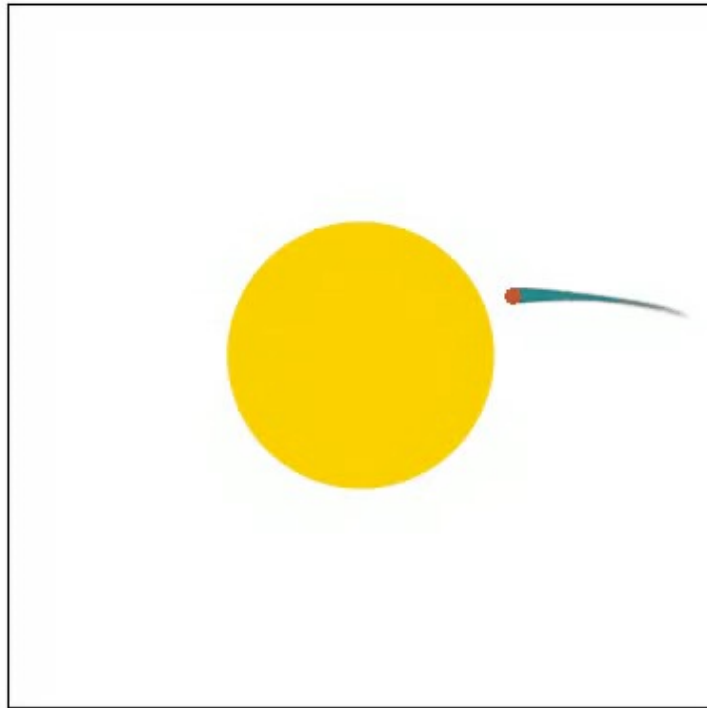
Light-curve plots: van Lieshout & Rappaport (2018)

MODELLING DISINTEGRATING ROCKY EXOPLANETS

van Lieshout & Rappaport (2016)



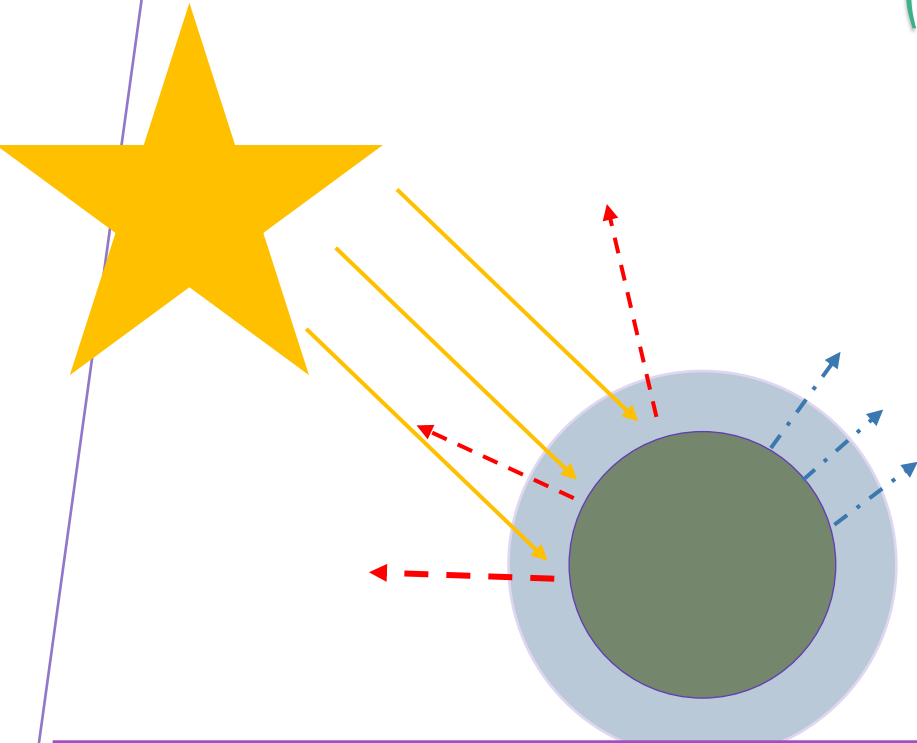
MODELLING DISINTEGRATING ROCKY EXOPLANETS



Simulation and synthetic light-curve of KIC 1255b

MODELLING ROCKY (EXO)PLANET'S ATMOSPHERES

from a stellar atmospheric model, MARCS
(Gustafsson et al., 2008)

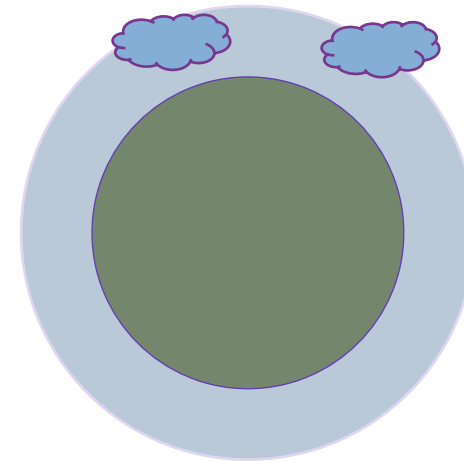
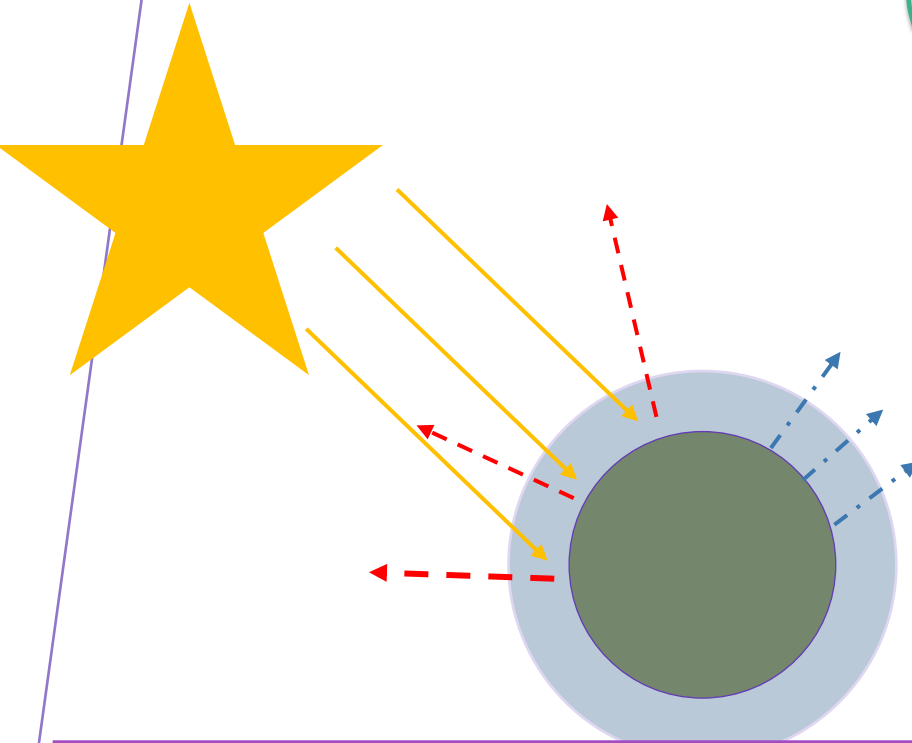


To consider in primary models:

- Stellar radiation (solid/yellow arrows);
- Reflected stellar radiation (dashed/red arrows);
- Surface thermal radiation (dot-dashed/blue arrows);

MODELLING ROCKY (EXO)PLANET'S ATMOSPHERES

from a stellar atmospheric model, MARCS
(Gustafsson et al., 2008)



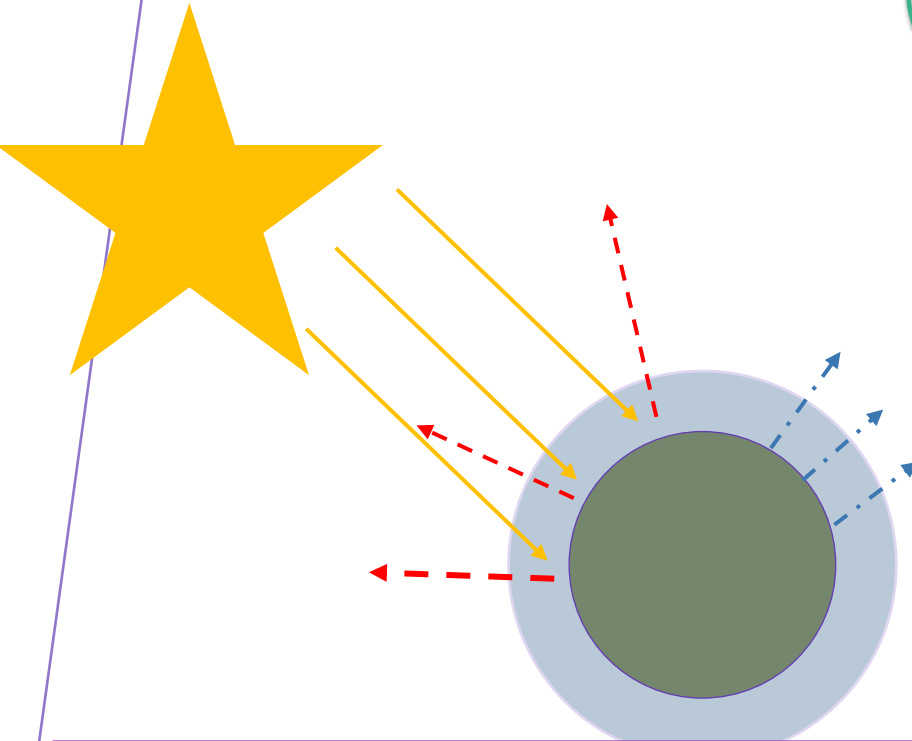
Models with simple cloud formation and equilibrium chemistry, with the use of GGchem (Woitke et al, 2018)

To consider in primary models:

- Stellar radiation (solid/yellow arrows);
- Reflected stellar radiation (dashed/red arrows);
- Surface thermal radiation (dot-dashed/blue arrows);

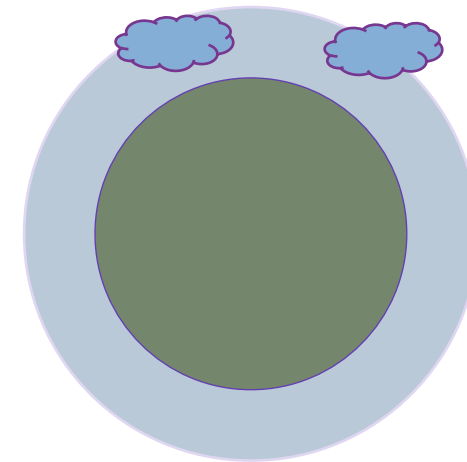
MODELLING ROCKY (EXO)PLANET'S ATMOSPHERES

from a stellar atmospheric model, MARCS
(Gustafsson et al., 2008)

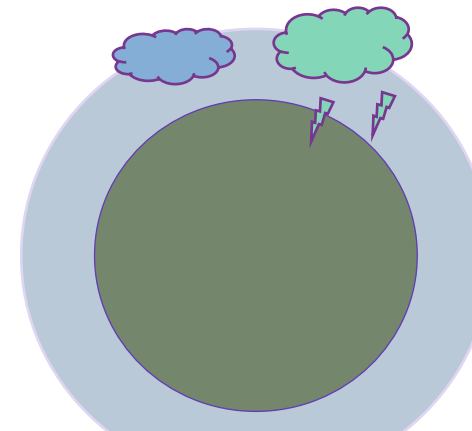


To consider in primary models:

- Stellar radiation (solid/yellow arrows);
- Reflected stellar radiation (dashed/red arrows);
- Surface thermal radiation (dot-dashed/blue arrows);



Models with simple cloud formation and equilibrium chemistry, with the use of GGchem (Woitke et al, 2018)



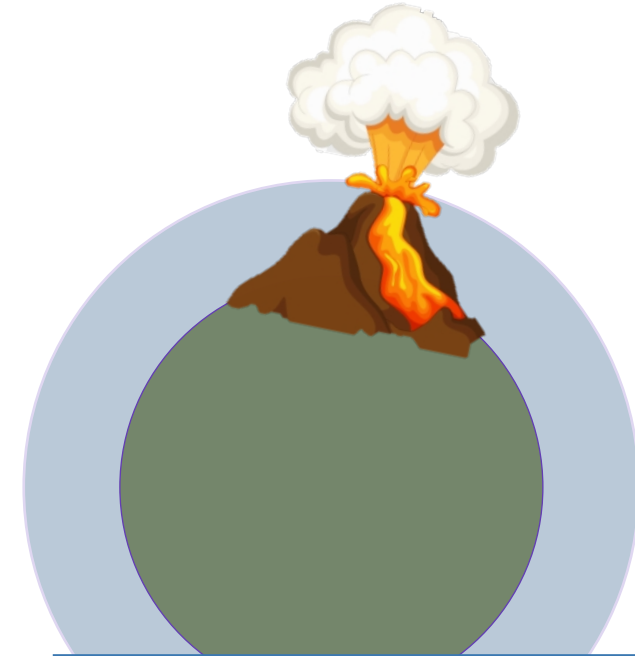
Models with detailed low temperature gas and cloud chemistry, with the use of DRIFT (Helling et al, 2016)

MODELLING ROCKY (EXO)PLANET'S ATMOSPHERES

from a stellar atmospheric model, MARCS
(Gustafsson et al., 2008)



Comparison to future observations
of planetary atmospheres



Possible inclusion of more
complicated mechanisms, such
as volcanism

THANK YOU FOR LISTENING!

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement no. 860470.



@exobeatriz



@beatrizestrada



<https://beatrizestrada.github.io>



beatriz.estrada@nbi.ku.dk

