

Oliver Herbort



Title

From clouds to crust - Cloud diversity and surface conditions in atmospheres of rocky exoplanets

Abstract

One of the fundamental questions for planetary science is how surfaces of other planets similar to the rocky bodies in our solar system look like. What is the rock structure like? Will there be water? Are there any active atmospheric cycles? How can we detect these different conditions?

The current space missions and ground based instruments allow the detection of specific gas species and some cloud compositions in atmospheres of giant exoplanets. With instruments installed in the near future and space crafts currently being build or planned, these kind of observations will be available for planets with smaller sizes and an overall rocky composition. We aim to further understand the connection of the conditions of the upper atmosphere with the conditions on the crust of the planet (temperature, pressure, composition).

Our equilibrium chemistry models allow us to investigate the expected crust and near-crust-atmosphere composition based. With this, we investigate the conditions under which liquid water is actually stable at the surface of a planet and not incorporated in hydrated rocks. Based on this crust - near-crust-atmosphere interaction we build an atmospheric model, which allows us to investigate what kind of clouds are stable and could be present in atmospheres of rocky exoplanets. This allows us to link the high altitude gas phase and cloud compositions to the surface conditions.

Contact information

St Andrews Centre for Exoplanet Science
School for Physics and Astronomy
School for Earth and Environmental Studies

Address: University of St Andrews
North Haugh
KY169SS St Andrews
Scotland, United Kingdom

email: oh35@st-andrews.ac.uk
web: oliver.herbert.wordpress.com

Academic Career**2018 - 2022 PhD Student Astrophysics**

University of St Andrews, Scotland
Thesis title: Atmospheres of Rocky Exoplanets
Supervisors: Dr. Peter Woitke and Dr. Aubrey Zerkle

2016 - 2018 Master of Science Physics

Georg August Universität, Göttingen, Germany
Thesis title: Stellar activity of CN Leo
Supervisor: Prof. Ansgar Reiners
CARMENES consortium

2016 - 2017 Erasmus Semester

at Uniwersytet Jagielloński, Cracow, Poland

2013 - 2016 Bachelor of Science Physics

Georg August Universität, Göttingen, Germany
Thesis title: Intermediate Mass Black Holes in Globular Clusters
Supervisor: Prof. Stefan Dreizler

Research Interest

My research focusses on combining astrophysical and geological knowledge in order to understand the interaction of atmospheres and the surface of rocky exoplanets. The observable composition of the atmosphere of an exoplanet provides clues on its surface conditions (rock composition, surface temperature and pressure). The diversity of cloud species can help to understand these surface conditions.

Rocky exoplanets - habitable worlds to magma oceans; what they are made of and how can information on the surface conditions be inferred from observations; understanding habitable conditions (Stability of liquid water, further potential life cycles comparable and beyond those on Earth); interaction of host stars and exoplanets; how can stellar activity affect atmospheres; diversity of clouds (various temperature regimes)

Publications (as of 17/12/2020)

Publications: 5 (1 first author, 1 second author, 1 submitted)
Citations: 63 (4 as first author)

Coexistence of CH₄, CO₂ and H₂O in exoplanet atmospheres

[Woitke, Herbort et al. 2020](#), A&A, Forthcoming article

The atmospheres of rocky exoplanets. I. Outgassing of common rock and the stability of liquid water

[Herbort et al. 2020](#), A&A, 636 (2020) A71

Understanding the atmospheric properties and chemical composition of the ultra-hot Jupiter HAT-P-7b

[Helling et al. 2019](#) A&A 631, A79 (2019)

CARMENES: high-resolution spectra and precise radial velocities in the red and infrared

[Quirrenbach et al. 2018](#) Proc. SPIE 10702

Conferences and Colloquia ([full list here](#))

CHAMELEON Introduction Meeting	Nov 2020	talk
Colloquium Thüringische Landessternwarte Tautenburg,	Nov 2020	talk
Diversity of Rocky Exoplanets, Lorentz Center Leiden	Oct 2020	
NOVO Nordisk Meeting	July 2020	talk
Scottish Exoplanet and Brown Dwarf Meeting 10, St Andrews	Oct 2020	talk
Exoplanets III, Heidelberg/online	July 2020	Poster
Rocky World Workshop, Cambridge	Jan 2020	Poster
Scottish Exoplanet and Brown Dwarf Meeting 9, Edinburgh	Sep 2019	talk
Scottish Exoplanet and Brown Dwarf Meeting 8, St Andrews	April 2019	talk
Universität Bielefeld Astrobiology Colloquium	Jan 2019	talk
Cloud Academy, École des physique des Houches	Sep 2018	

Teaching experience

2018 -	Tutor, lab demonstrator (Astronomy undergraduate courses), University of St Andrews
2018 -	Telescope teaching for undergraduate students, University of St Andrews
2018 - 2020	Journal Club organisation, St Andrews Centre for Exoplanet Science
2017 - 2018	Lab demonstrator (physics lab for physicists and non physicists), Georg August Universität

Outreach and Public engagement

2018 -	Mobile planetarium, University of St Andrews - lead organiser
2018 -	Various science outreach days, University of St Andrews
2016	Physics experiments in schools in South Africa during an excursion (Georg August Universität, Universität Kassel)