Universiteit
Leiden
The Netherlands

Optical and infrared phase curves of the lava planet K2-141 b

Zieba, S.; Zilinskas, M.; Kreidberg, L.; Cowan, N.; Nguyen, G.; Miguel, Y.; ... ; Carone, L.

Citation

Zieba, S., Zilinskas, M., Kreidberg, L., Cowan, N., Nguyen, G., Miguel, Y., ... Carone, L. (2021). Optical and infrared phase curves of the lava planet K2-141 b. *Epsc Abstracts*, EPSC2021-476. doi:10.5194/epsc2021-476

Version: Publisher's Version

License: [Creative Commons CC BY 4.0 license](https://creativecommons.org/licenses/by/4.0/)

Downloaded from: <https://hdl.handle.net/1887/3275512>

Note: To cite this publication please use the final published version (if applicable).

Optical and Infrared Phase Curves of the Lava Planet K2-141 b

Sebastian Zieba^{1,2}, Mantas Zilinskas², Laura Kreidberg¹, Nicolas Cowan^{3,4,5}, Giang Nguyen⁶, Yamila Miguel², Raymond Pierrehumbert⁷, Roxana Lupu⁸, Lisa Dang^{3,4}, Mark Hammond⁹, Luca Malavolta¹⁰, and Ludmila Carone¹

¹Max-Planck-Institut für Astronomie, Königstuhl 17, 69117 Heidelberg, Germany (zieba@mpia.de)

²Leiden Observatory, Leiden University, Niels Bohrweg 2, 2333CA Leiden, The Netherlands

³Department of Physics, McGill University, 3600 rue University, Montréal, QC H3A 2T8, Canada

⁴McGill Space Institute; Institute for Research on Exoplanets; Centre for Research in Astrophysics of Quebec

⁵Department of Earth & Planetary Sciences, McGill University, 3450 rue University, Montréal, QC H3A 0E8, Canada

⁶Centre for Research in Earth and Space Sciences, York University, 4700 Keele st., Toronto, Ontario, M3J 1P3, Canada

⁷Department of Physics (Atmospheric, Oceanic and Planetary Physics), University of Oxford, Parks Rd, Oxford, OX1 3PU, UK

⁸BAER Institute, NASA Ames Research Center, Naval Air Station, Moffett Field, CA 94035, USA

⁹Department of the Geophysical Sciences, University of Chicago, USA

¹⁰Dipartimento di Fisica e Astronomia "Galileo Galilei", Università di Padova, Padua, Italy

K2-141 b is a transiting, small (1.5 RE) Ultra-Short-Period (USP) planet orbiting its star every 6.7 hours discovered by the Kepler space telescope. The planet's high surface temperature of more than 2000 K makes it an excellent target for atmospheric studies by the observation of its thermal emission. We present 65 hours of continuous photometric observations of K2-141 b collected with Spitzer's IRAC Channel 2 at 4.5 microns spanning 10 full phases of the orbit. Our best fit model of the Spitzer data shows no significant offset of the thermal hotspot and is inconsistent with the observed offset of the well-studied USP planet 55 Cnc e at a 3.7 sigma level. We measure an eclipse depth of 142 +/- 40 ppm and an amplitude variation of 120 +/- 40 ppm in the infrared. The joint analysis of the observations collected in the two photometric bands favors a non-zero geometric albedo with $A_g = 0.26 \pm 0.07$ and a tentative temperature gradient. With a dayside temperature of 2141 -361 +352 K and a night-side temperature of 1077 -623 +473 K we also find no evidence of heat redistribution on the planet. We compare the observations to a 1D rock vapor model and a 1D circulation toy model and argue that the data are best explained by a thin rock vapor atmosphere with a thermal inversion.