

An atlas of resolved spectral features in the transmission spectrum of WASP-189 b using MAROON-X

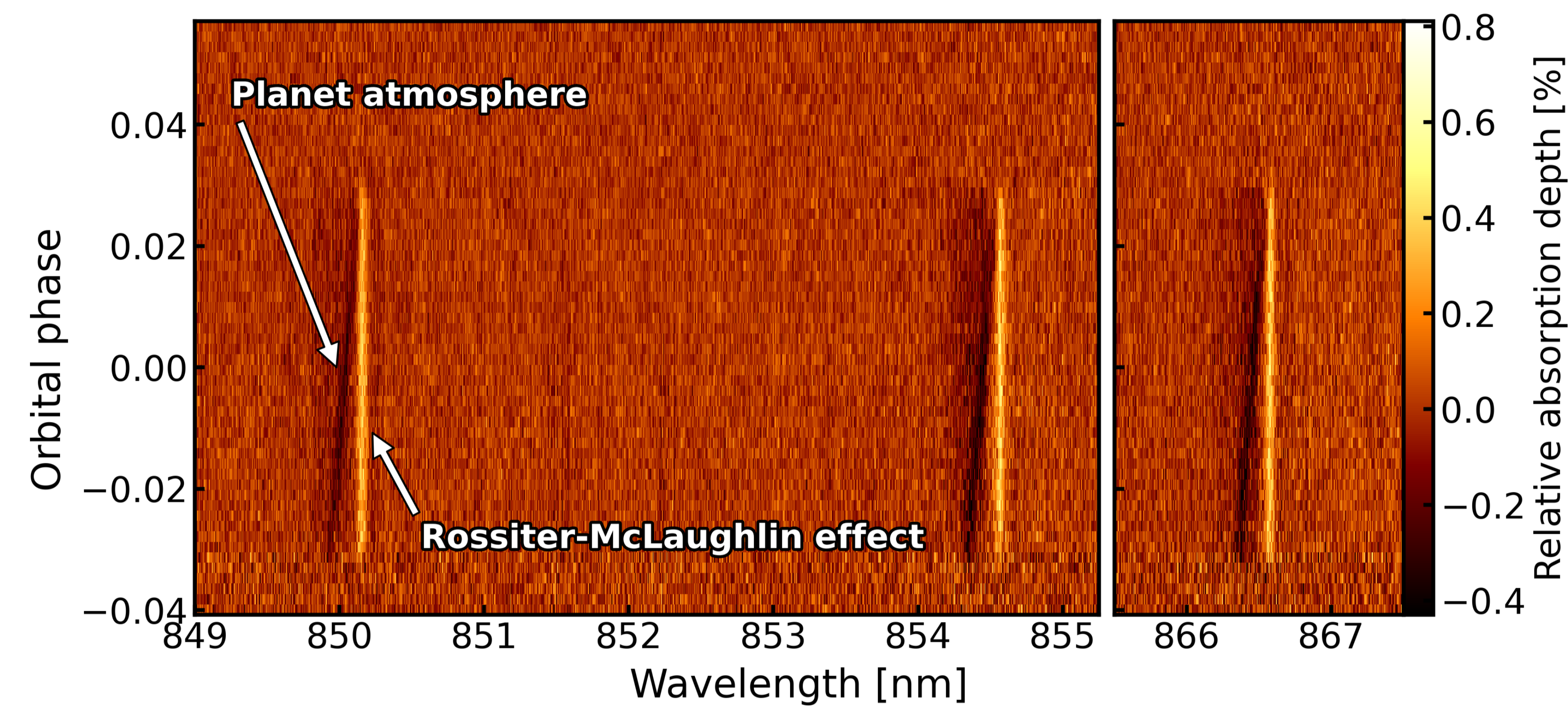
A true treasure hunt and benchmark



by Bibiana Prinoth

WHAT WE DID: *Narrow-band spectroscopy with time-resolved lines*

- We observed **two transits** of the ultra-hot Jupiter WASP-189 b with MAROON-X/Gemini-North to probe its high-altitude atmospheric layers, using **strong absorption lines**.
- We derived **posterior probability distributions for the planetary and stellar parameters** by calculating the stellar spectrum behind the planet at every orbital phase during the transit.



WHAT WE FOUND: *A treasure chest full of absorption lines*

- Single line absorption** of Ca⁺, Ba⁺, Na, H α , Mg, Fe, and Fe⁺
- Time-resolved line absorption** of the Ca⁺ infrared triplet that allows us to fit stellar and planetary parameters

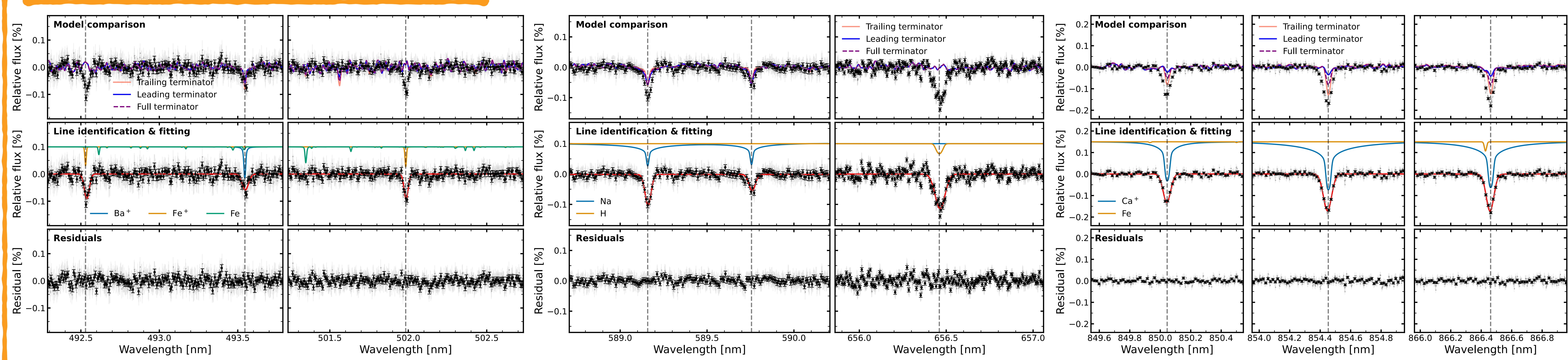
		Amplitude [ppm]	Line centre [nm]	Line width [nm]	Line width [km/s]	Velocity shift w.r.t. line centre [km/s]	Detection significance	Eq. atm. height h [Planetary radii]
Fe ⁺	492.53	918 ± 79	492.537 ± 0.002	0.016 ± 0.002	9.69 ± 0.96	4.62 ± 0.96	11.6	1.0806 ± 0.0070
Ba ⁺	493.55	591 ± 68	493.548 ± 0.003	0.020 ± 0.003	12.24 ± 1.63	1.55 ± 1.63	8.7	1.0526 ± 0.0061
Fe ⁺	501.98	929 ± 72	501.986 ± 0.001	0.013 ± 0.001	7.73 ± 0.69	1.47 ± 0.69	12.9	1.0815 ± 0.0064
Mg	517.41	331 ± 25	517.417 ± 0.001	0.015 ± 0.001	8.70 ± 0.77	2.53 ± 0.76	13.2	1.0296 ± 0.0024
Mg	518.50	427 ± 76	518.507 ± 0.002	0.011 ± 0.002	6.08 ± 1.25	1.55 ± 1.25	5.6	1.0383 ± 0.0068
Na	589.16	1016 ± 39	589.160 ± 0.001	0.017 ± 0.001	8.87 ± 0.39	0.88 ± 0.4	26.1	1.0888 ± 0.0040
Na	589.76	540 ± 37	589.759 ± 0.001	0.019 ± 0.001	9.49 ± 0.75	1.74 ± 0.75	14.6	1.0482 ± 0.0035
Ba ⁺	614.34	346 ± 27	614.341 ± 0.003	0.030 ± 0.003	14.74 ± 1.35	-0.11 ± 1.34	12.8	1.0311 ± 0.0026
H α	656.46	1184 ± 23	656.464 ± 0.001	0.028 ± 0.001	12.83 ± 0.3	1.55 ± 0.30	51.5	1.1029 ± 0.0033
Ca ⁺	850.05	1322 ± 38	850.043 ± 0.001	0.025 ± 0.001	8.68 ± 0.29	-0.78 ± 0.29	34.8	1.1136 ± 0.0043
Ca ⁺	854.45	1711 ± 31	854.448 ± 0.001	0.027 ± 0.001	9.51 ± 0.20	-1.89 ± 0.20	55.2	1.1449 ± 0.0044
Ca ⁺	866.46	1723 ± 29	866.458 ± 0.001	0.025 ± 0.001	8.70 ± 0.17	-1.41 ± 0.17	59.4	1.1458 ± 0.0044

WHAT WE CONCLUDE: *A benchmark set for the community*

These high signal-to-noise observations of WASP-189 b provide a benchmark data set for testing high-resolution retrievals and the assumptions of atmospheric models.

Amplitude of planetary absorption [%]	-1.641 ± 0.063
Centre wavelength [nm]	850.042 ± 0.001
Slope of absorption	0.523 ± 0.012
Gaussian width of absorption [nm]	0.029 ± 0.001
Planet-to-star radii ratio	0.074 ± 0.001
Projected spin-orbit angle [deg]	90.07 ± 0.24
Projected rotational velocity [km/s]	95.05 ± 0.55

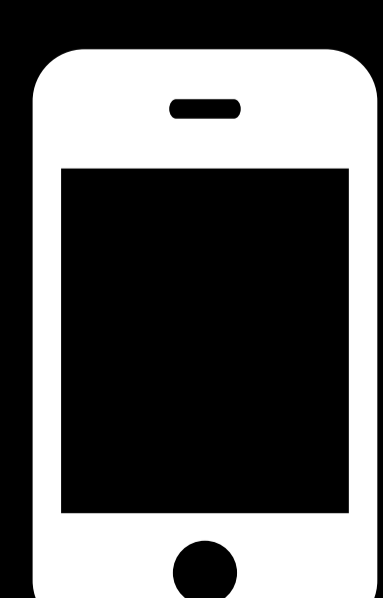
A sneak peek into the treasure chest



B. Prinoth, H. J. Hoeijmakers, B. M. Morris, M. Lam, D. Kitzmann, E. Sedaghati, J. V. Seidel, E. K. H. Lee, B. Thorsbro, N. W. Borsato, Y. C. Damasceno, S. Pelletier, A. Seifahrt



Scan the code to download the full paper



LUNDS UNIVERSITET



✉ bibiana.prinoth@fysik.lu.se — [bprinoth.github.io](https://github.com/bprinoth) — [Facebook](https://www.facebook.com/bibianaprinoth) [Instagram](https://www.instagram.com/bibianaprinoth) [LinkedIn](https://www.linkedin.com/company/bibianaprinoth) [YouTube](https://www.youtube.com/channel/UC...) [TikTok](https://www.tiktok.com/@bibianaprinoth) @bibianaprinoth