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Title: Kepler-77b: a low albedo, Saturn-mass transiting planet
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Abstract: D. Gandolfi, M. Fridlund, A. P. Hatzes, H. J. Deeg, A. Frasca, A. F. Lanza, P. G. Prada Moroni, E. Tognelli, A. McQuillan, S. Aigrain, R. Alonso, V. Antoci, J. Cabrera, L. Carone, Sz. Csizmadia, A. A. Djupvik, E. W. Guenther, J. Jessen-Hansen, A. Ofir and J. Telling

We report the discovery of Kepler-77b, a Saturn-mass transiting planet in a 3.6-day orbit around a metal-rich solar-like star. We combined the Kepler photometry with high-resolution spectroscopy from the Sandiford at McDonald and FIES at NOT spectrographs.

We derived the system parameters via a simultaneous joint fit to the photometric and radial velocity measurements. Our analysis is based on the Bayesian approach and is carried out by sampling the parameter posterior distributions using a Markov chain Monte Carlo simulation. Kepler-77b is a moderately inflated planet with a mass of $M_p = 0.430 \pm 0.032 M_{\text{Jup}}$, a radius of $R_p = 0.960 \pm 0.016 R_{\text{Jup}}$, and a bulk density of $\rho_p = 0.603 \pm 0.055 \text{ g cm}^{-3}$. It orbits a slowly rotating (Prot = 36 ± 6 days) G5 V star with $M_* = 0.95 \pm 0.04 M_{\odot}$, $R_* = 0.99 \pm 0.02 R_{\odot}$, $T_{\text{eff}} = 5520 \pm 60 \text{ K}$, $[M/H] = 0.20 \pm 0.05$ dex, that has an age of 7.5 ± 2.0 Gyr. The lack of detectable planetary occultation with a depth higher than ~ 10 ppm implies a planet geometric and Bond albedo of $A_g \leq 0.087 \pm 0.008$ and $A_B \leq 0.058 \pm 0.006$, respectively, placing Kepler-77b among the gas-giant planets with the lowest albedo known so far. We found neither additional planetary transit signals nor transit-timing variations at a level of ~ 0.5 min, in accordance with the trend that close-in gas giant planets seem to belong to single-planet systems. The 106 transits observed in short-cadence mode by Kepler for nearly 1.2 years show no detectable signatures of the planet's passage in front of starspots. We explored the implications of the absence of detectable spot-crossing events for the inclination of the stellar spin-axis, the sky-projected spin-orbit obliquity, and the latitude of magnetically active regions.