GJ 724b: the most eccentric single-planet around an M dwarf

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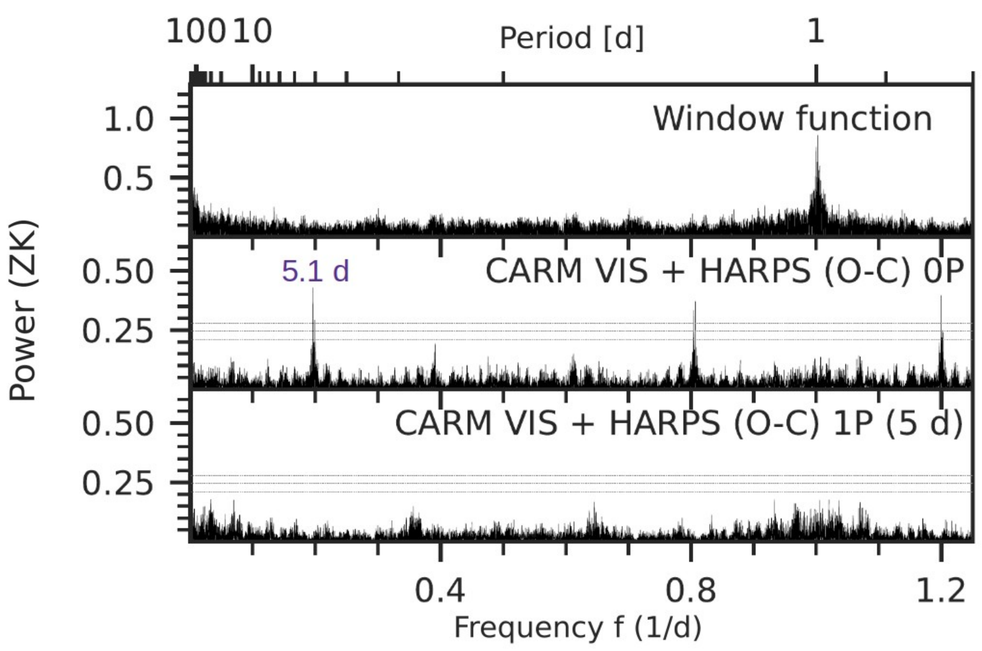
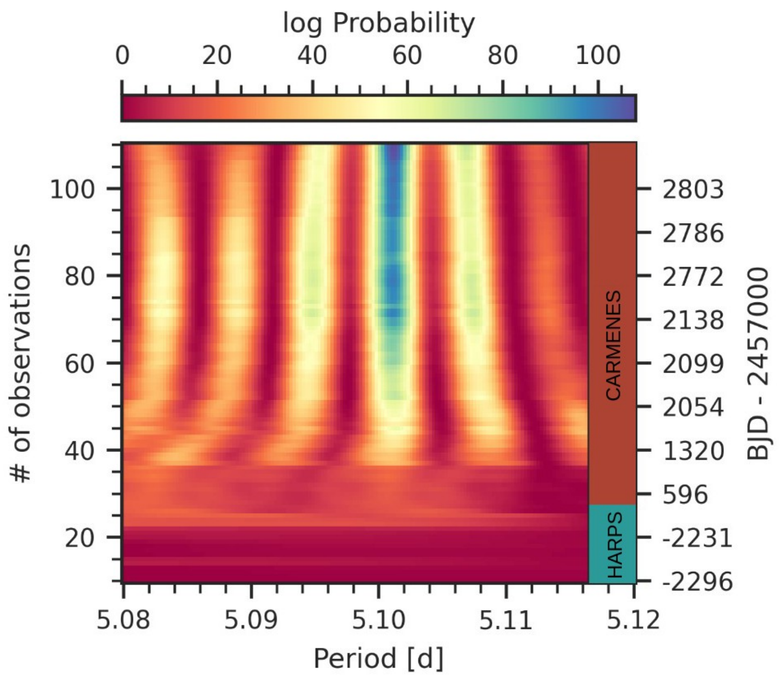
Abstract

GJ 724 was observed with **CARMENES** as part of the Guaranteed Time Observations to search for exoplanets around M dwarfs. Using additional archival data from **HARPS**, we ran Keplerian models considering different orbital configurations. In addition, Gaussian processes were used to account for stellar activity. Our results show that all models favour a **planet candidate** with an orbital **period of 5.1 d**. The s-BGLS periodogram shows that this **signal is stable over time**. Moreover, there is no other counterpart in the activity indicators. Therefore, **we qualified the 5.1 days signal as a planet (GJ 724b).** According to the Bayesian evidence, this is the **only planet in the system**. The orbital parameters indicate that GJ 724b has a highly eccentric orbit **(e=0.58±0.05)**, making it the **most eccentric single-planet around an M dwarf to this day**. We discuss our discovery in the context of planetary architecture and formation.

Introduction

→ There is a significant signal in the RVs at 5.1 d





Interpretation

→ Additional (undetectable) companion in the system (M sin *i* < 10.75 M⊕ from detection map)

→ Tidal in-spiral migration, perturbation or scattering event in the early stage of the system

→ Kozai effect

Read the paper
(Gorrini et al. 2023)

Results

→ Most eccentric single-planet around an M dwarf

Model	ln $\mathcal{Z}$	Δ ln $\mathcal{Z}$	max. log $\mathcal{L}$
	Only Keplerian		
0P	−353.3	−33.7	−342.9
$1P_{(5d\text{-}ecc)}$	−319.6	0.0	−287.0
$1P_{(5d\text{-}circ)}$	−341.2	−21.6	−315.4
$2P_{(circ,\ 5d,\ 2.55d)}$	−337.3	−17.7	−292.8
	With GP		
$0P_{(dSHO\text{-}28d)}$	−356.7	−41.4	−338.6
$1P_{(5d\text{-}ecc,\ dSHO,\ 28d)}$	−315.3	0.0	−269.3
$1P_{(5d\text{-}circ,\ dSHO,\ 28d)}$	−342.1	−26.8	−307.9
$2P_{(circ,\ 5d,\ 2.55d,\ dSHO,\ 28d)}$	−335.9	−20.6	−279.8
$0P_{(dSHO\text{-}56d)}$	−356.9	−41.60	−339.9
$1P_{(5d\text{-}ecc,\ dSHO,\ 56d)}$	−320.9	−5.6	−275.0
$1P_{(5d\text{-}circ,\ dSHO,\ 56d)}$	−342.7	−27.4	−308.8
$2P_{(circ,\ 5d,\ 2.55d,\ dSHO,\ 56d)}$	−339.9	−24.6	−286.0