

# Atmosphere Models of Highly Irradiated Brown Dwarfs

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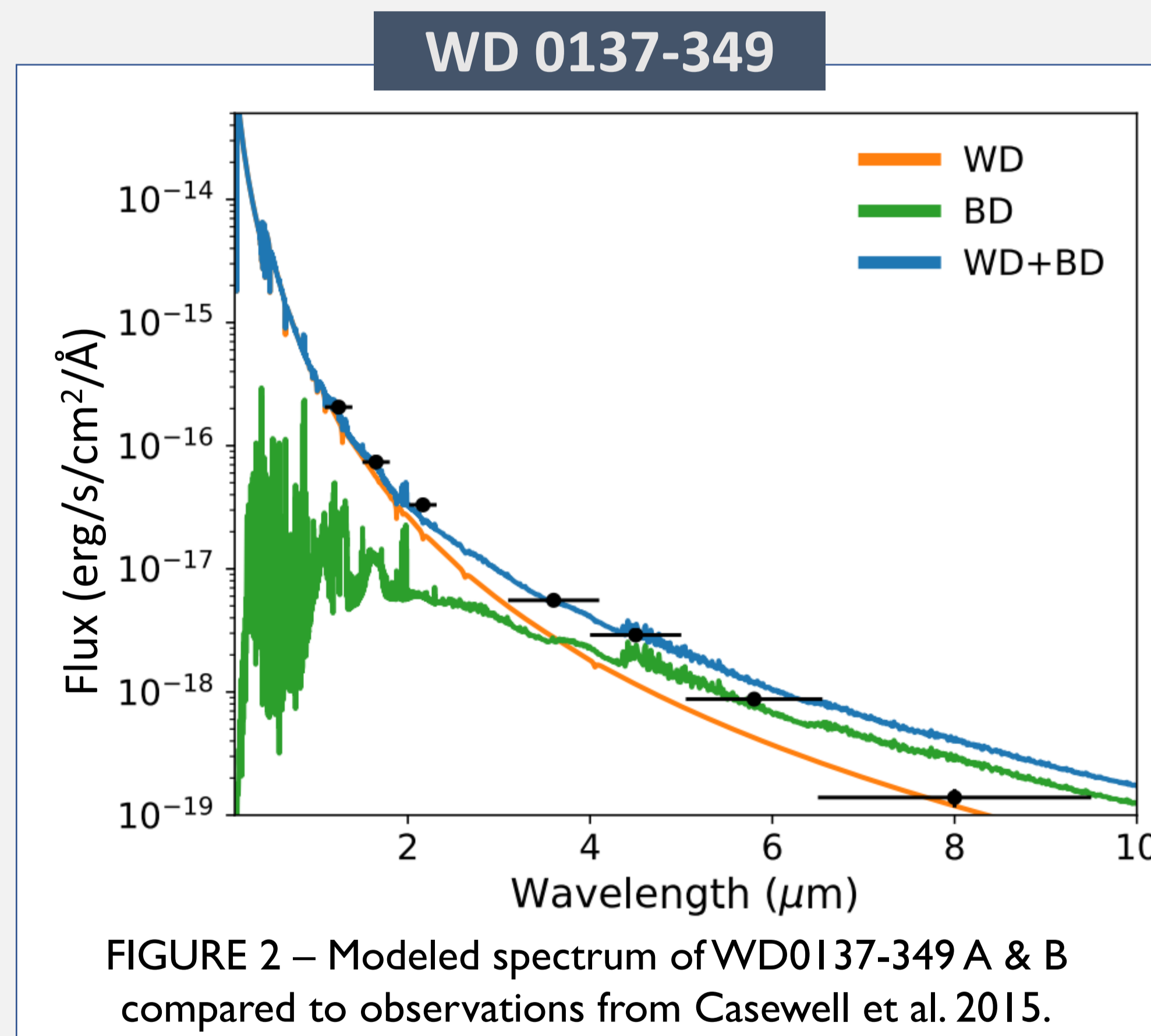
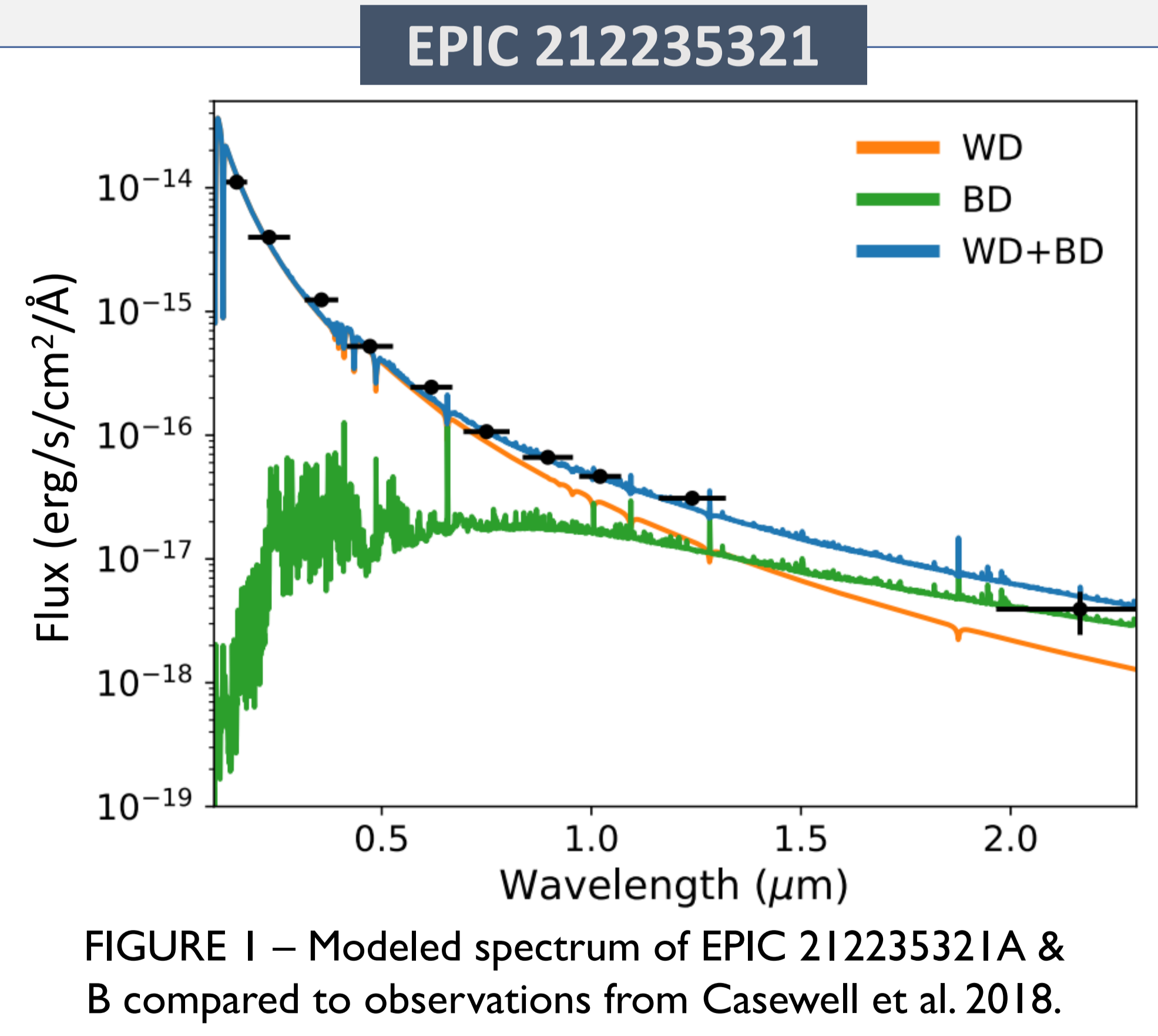
**What:** Only a handful of brown dwarfs (BDs) have been discovered orbiting on ultra-short periods around white dwarfs (WDs). These post-common envelope objects experience enough irradiation to heat them hundreds to thousands of Kelvin. Much of the irradiation can be in the ultraviolet, posing a challenge for models built for ultra-cool objects.

**How:** We use the PHOENIX<sup>1</sup> to self-consistently model the atmosphere of two of these extreme brown dwarfs. In the paper, we also use the PETRA<sup>2</sup> retrieval framework to measure the BD temperature structures.

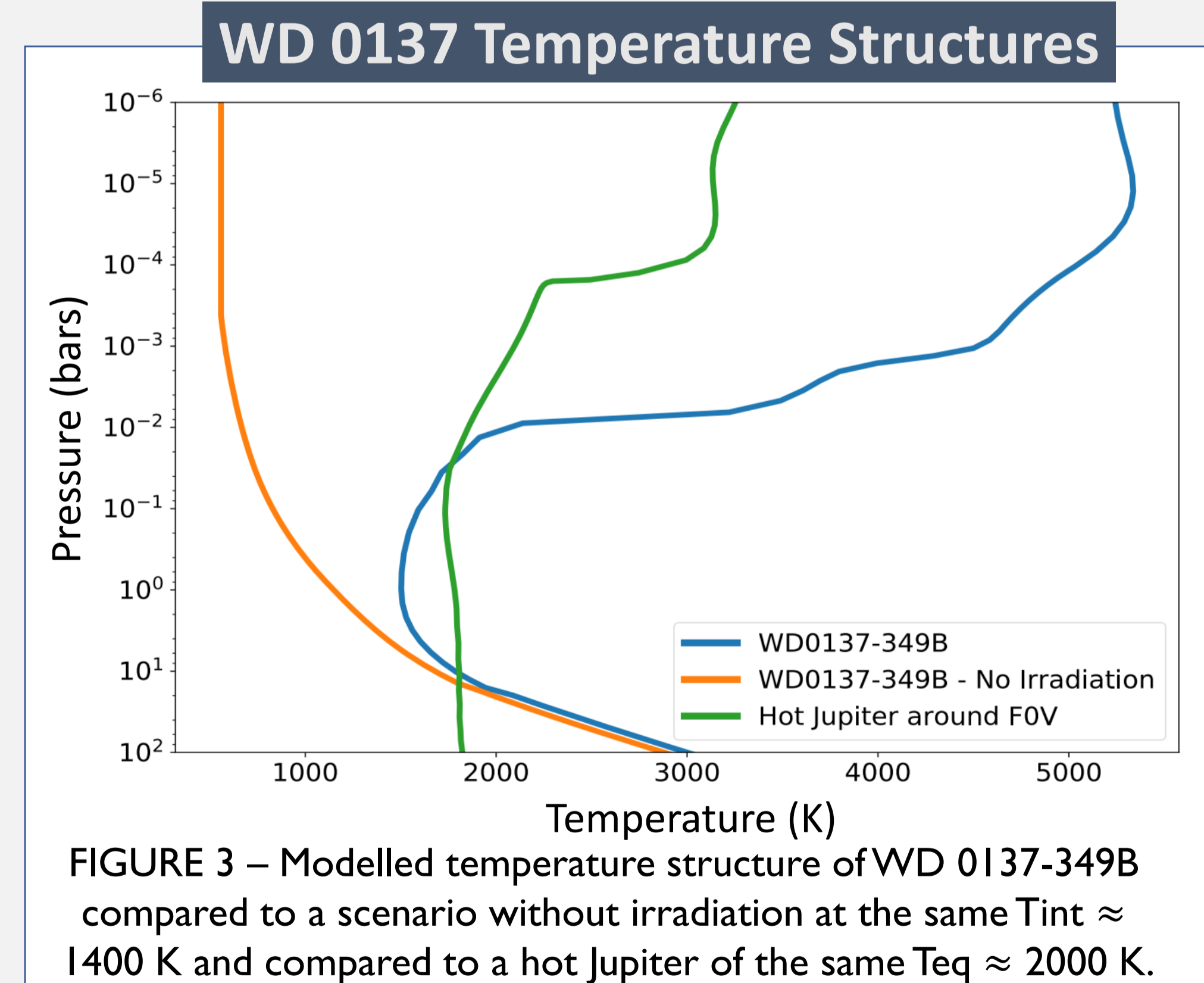
**Why:** These brown dwarfs provide excellent analogues for hot- and ultra-hot Jupiters. Unlike exoplanets, the IR flux ratio between the BD and WD can be  $>1$ . Multiple phase curves can be observed from the ground in a single night of observation. The BDs also provide a natural laboratory to explore the effects of short-wavelength irradiation which can drive the escape of exoplanet atmospheres.

**Results:** We can better match the low- and high-resolution observations when we take into account the short-wavelength irradiation (Fig 1,2). We also find that temperature inversions, or stratospheres, are created in the BD by the absorption of the short-wavelength irradiation by metals, similar to behavior seen in ultra-hot Jupiters (Fig. 3). This provides a natural explanation for the detections of atomic emission from the BD.

See the paper for much more:  
Lothringer & Casewell 2020  
*ApJ*, 905, 2. [arXiv:2010.14319](https://arxiv.org/abs/2010.14319)



**References**  
[1] Hauschildt, P. H., et al. (1998). *AJ*, 512, 1.  
[2] Lothringer, J. D., et al. (2020). *AJ*, 159, 6.



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