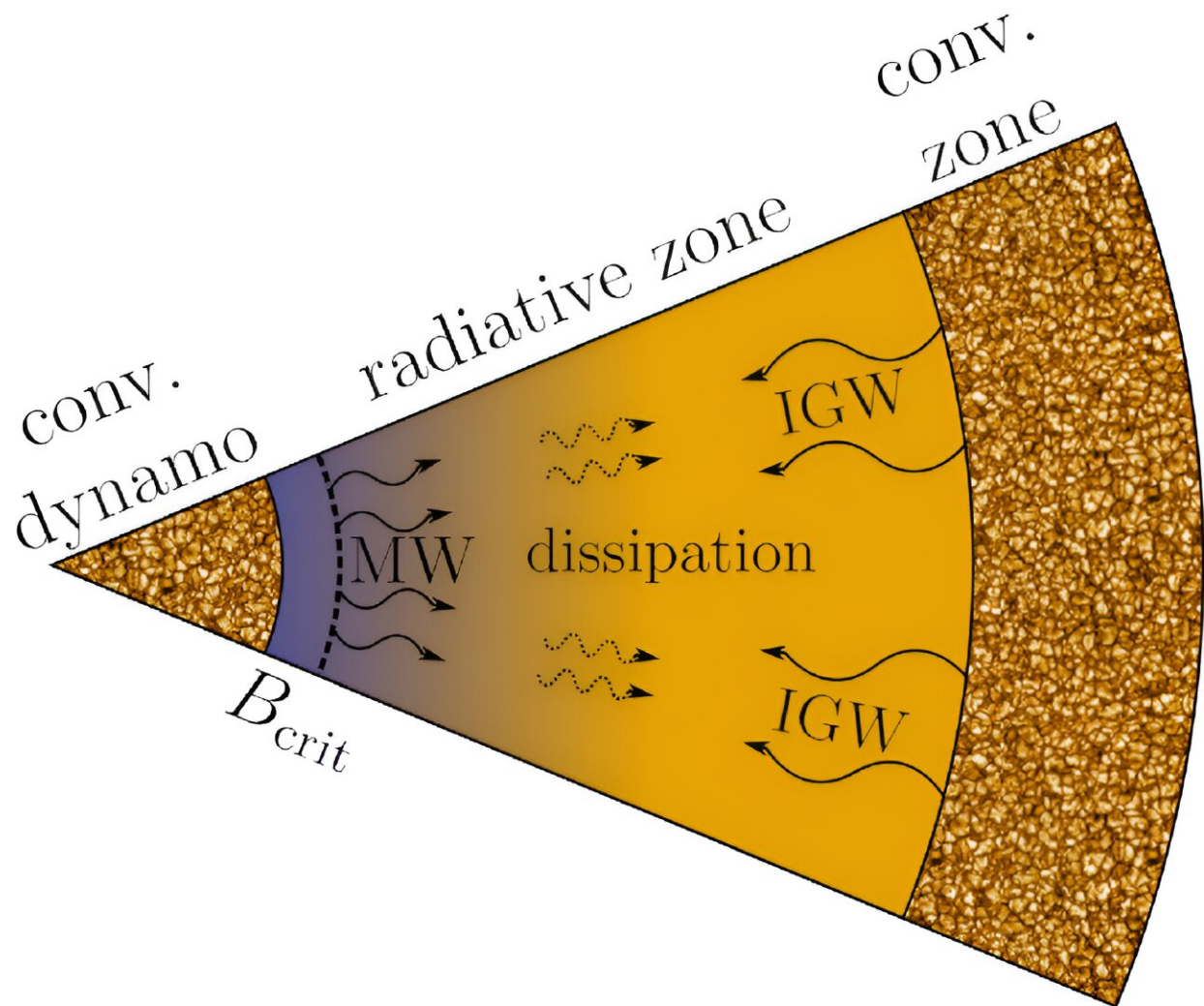


# New study reveals mystery of decaying exoplanet orbits

April 29 2024



Schematic of tidal dissipation due to wave conversion. Credit: *The Astrophysical Journal Letters* (2024). DOI: 10.3847/2041-8213/ad3c40

A new study led by researchers at Durham University has uncovered a novel mechanism that could solve a long-standing mystery about decaying planetary orbits around stars like our sun.

The [study](#), "An efficient tidal dissipation mechanism via stellar magnetic fields," published in *The Astrophysical Journal Letters*, proposes that stellar magnetic fields play a crucial role in dissipating the gravitational tides responsible for the orbital decay of "hot Jupiter" exoplanets.

Hot Jupiters are massive, gaseous planets similar to Jupiter that orbit extraordinarily close to their parent stars, taking only a few days to complete one orbit.

This close proximity subjects both the planet and star to powerful gravitational tides that transfer orbital energy, causing the planets to slowly spiral inwards over billions of years until they are eventually consumed.

Current tidal theories cannot fully explain the observation of orbital decay in the system WASP-12b, a hot Jupiter whose decaying [orbit](#) will send it into its host star WASP-12 in a few million years.

According to the research team, which included scientists from University of Leeds and Northwestern University alongside Durham, [strong magnetic fields](#) within certain sun-like stars can dissipate the gravitational tides from hot Jupiter planets very efficiently.

The tides create inward waves inside the stars. When these waves encounter the magnetic fields, they get converted into different types of magnetic waves that travel outwards and eventually disappear.

Reflecting on the research findings, lead author of the study Dr. Craig Duguid of Durham University, said, "This new mechanism has wide

reaching implications for the survival of short period planets and particularly hot Jupiters.

"It opens a new avenue of tidal research and will help guide observational astronomers in finding promising targets to observe orbital decay.

"It is also quite exciting that this new mechanism could be observationally tested within our lifetime."

The study findings suggest certain [nearby stars](#) may be good targets to search for additional hot Jupiter planets on decaying orbits.

If found, they could provide more evidence about how magnetic fields impact the tides from these alien worlds.

The research could also reveal where the dissipated tidal energy goes within the star's interior.

**More information:** Craig D. Duguid et al, An Efficient Tidal Dissipation Mechanism via Stellar Magnetic Fields, *The Astrophysical Journal Letters* (2024). [DOI: 10.3847/2041-8213/ad3c40](https://doi.org/10.3847/2041-8213/ad3c40).  
[iopscience.iop.org/article/10.3847/2041-8213/ad3c40](https://iopscience.iop.org/article/10.3847/2041-8213/ad3c40)

Provided by Durham University

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