Double tail structure in escaping atmospheres of magnetised close-in giant planets

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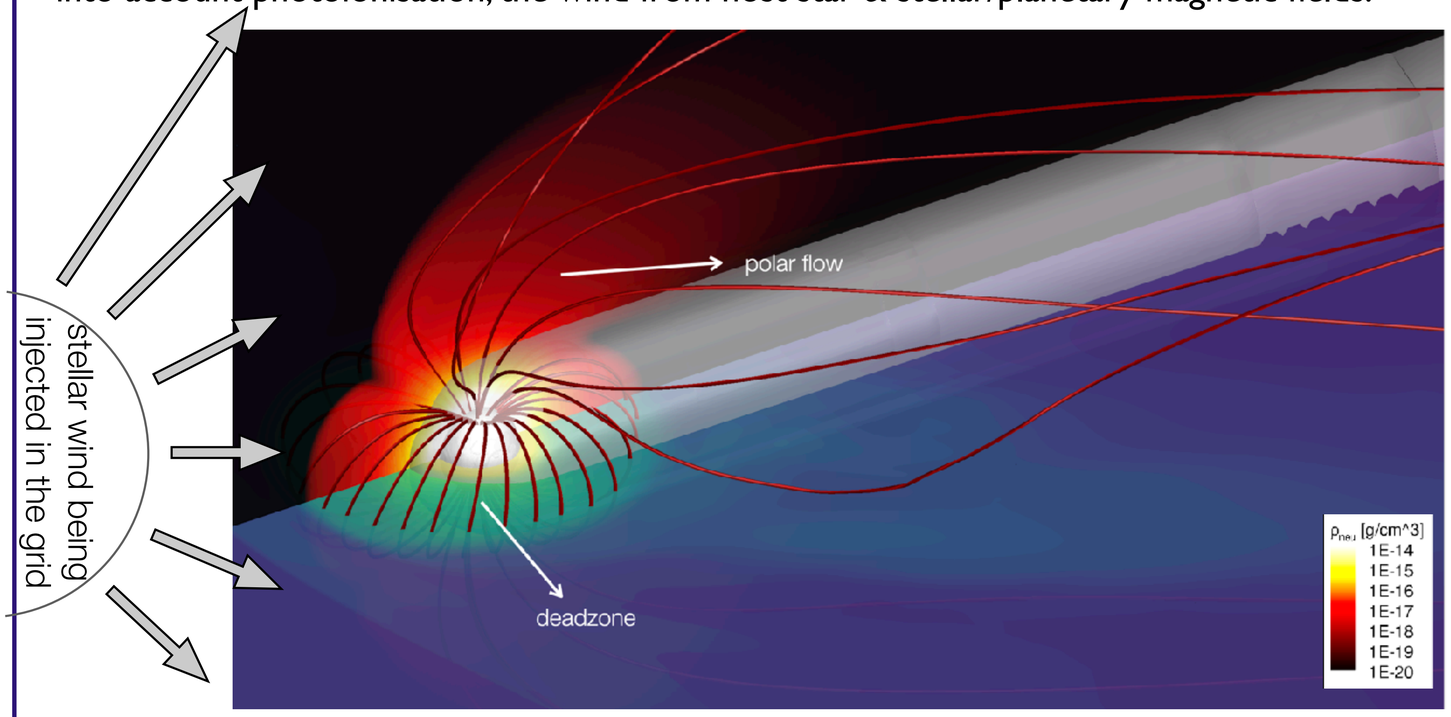
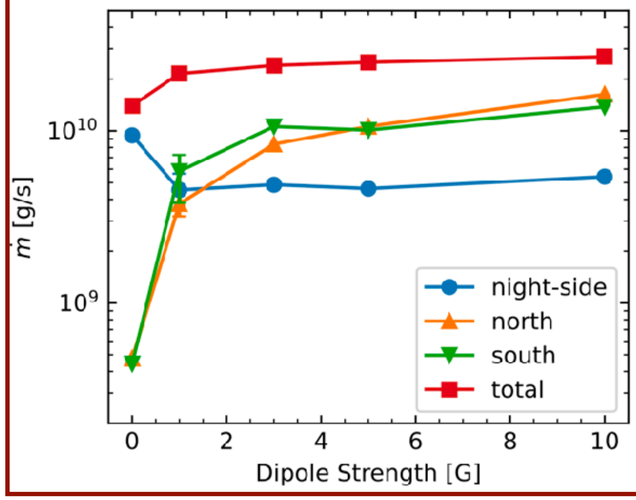
- High-energy stellar irradiation can photoevaporate planetary atmospheres, which can be observed in spectroscopic transits of hydrogen lines.
- **Goal:** we investigate the effect of planetary magnetic fields on the observational signatures of atmospheric escape in hot Jupiters.
- We model atmospheric escape in close-in giant planets using 3D MHD simulations that take into account photoionisation, the wind from host star & stellar/planetary magnetic fields.



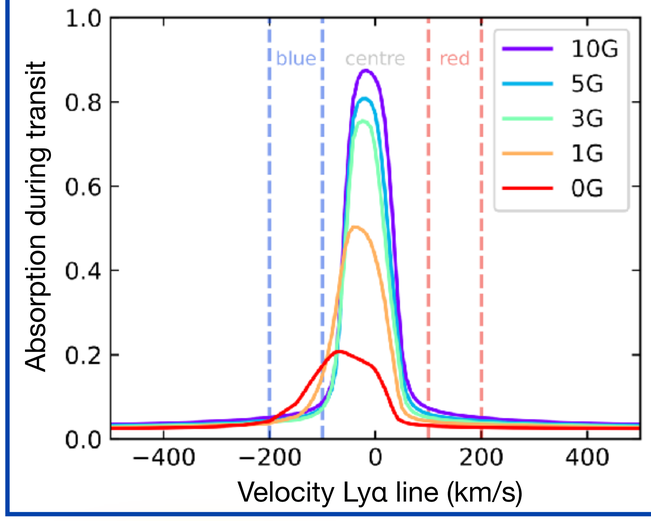
Magnetic field effects on evaporation rate



- weak increase in escape rate with increase in planetary magnetic field

Carolan, Vidotto+ 2021 MNRAS, 508 6001

Lyα transit observations strongly affected by planetary magnetism



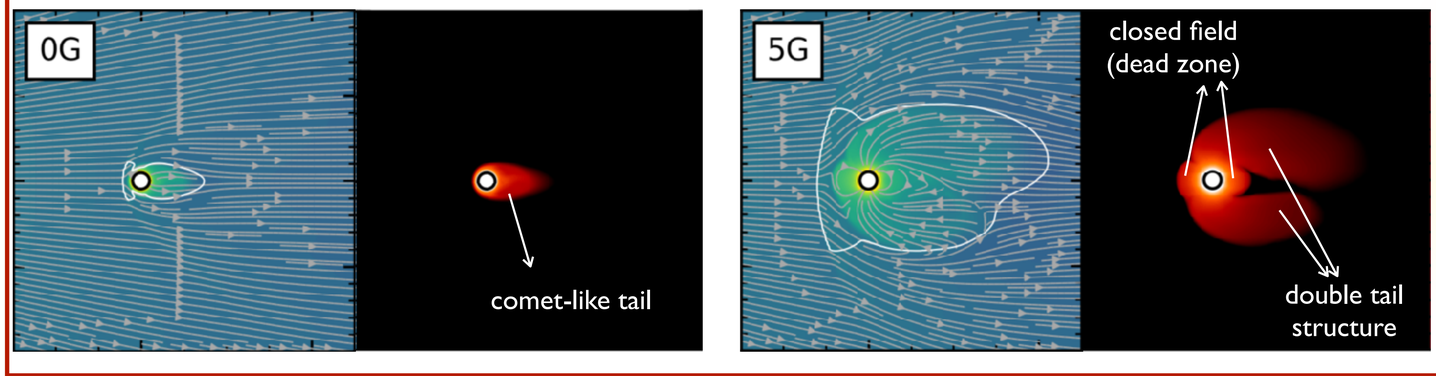
Including magnetic fields:

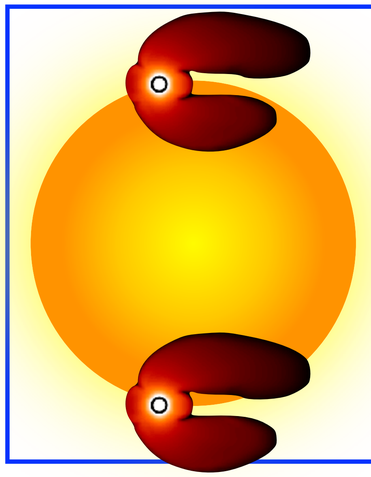
- Increases line centre absorption (dead-zones)
- Increases redshifted absorption (region between the tails)
- Initially decreases blue shifted absorption (funnelling material perpendicular to the line of sight)

Polar flows create a double-tail structure

- Magnetic fields change the dynamics of the escaping atmosphere
- formation of two "tails" originating from polar regions

Side view of the planet orbit: total & neutral H density





Fun fact: "North" & "South" tails are asymmetric

- more open field lines at North tail because of interaction (reconnection) with stellar wind magnetic field
- transit signature varies with impact parameter of the transit! North & South tails cover different areas of stellar disc
- can we differentiate this in observations? hmm, probably not (yet)