

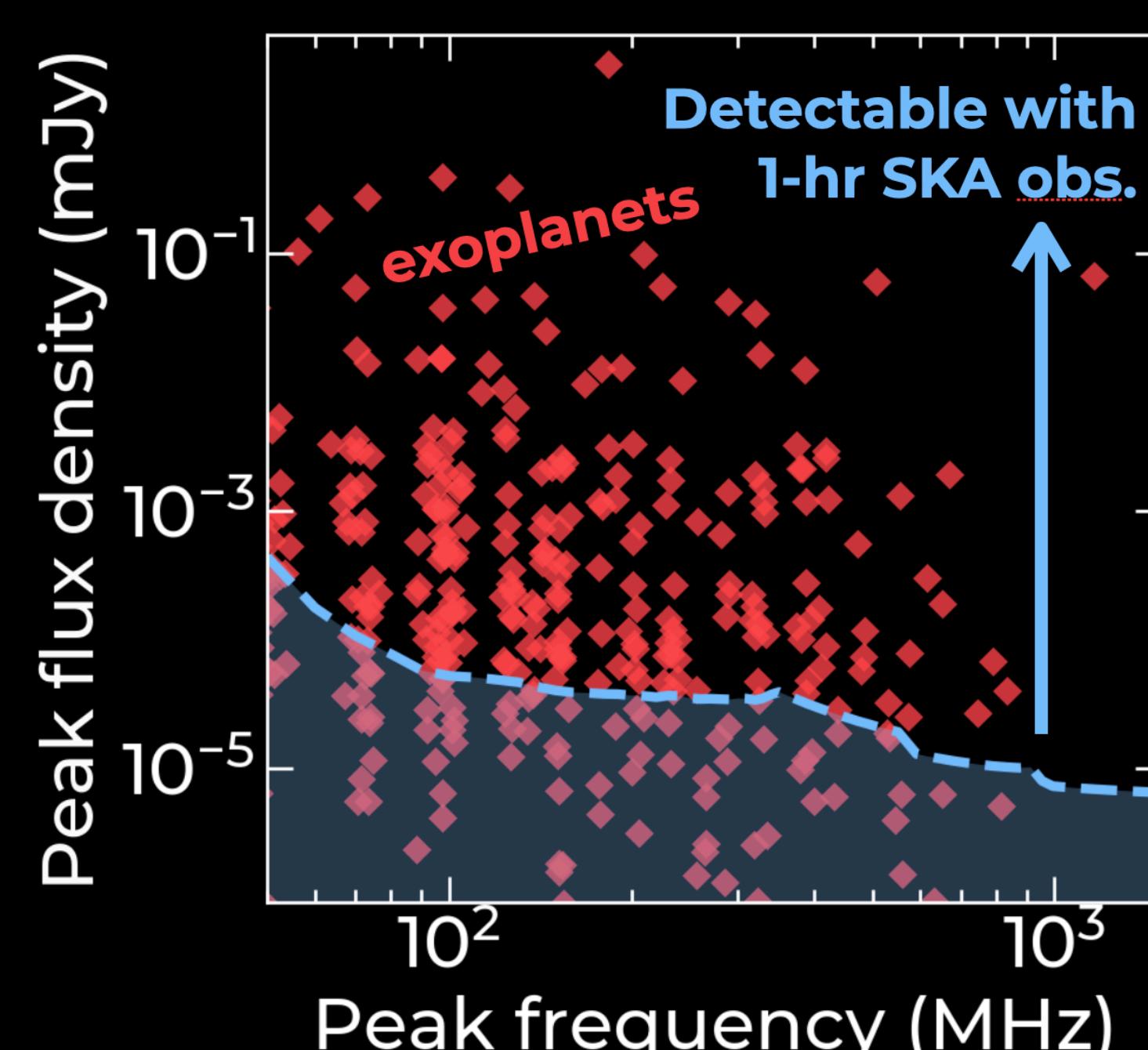
# Windows of discovery for brown dwarfs and exoplanets with the SKA

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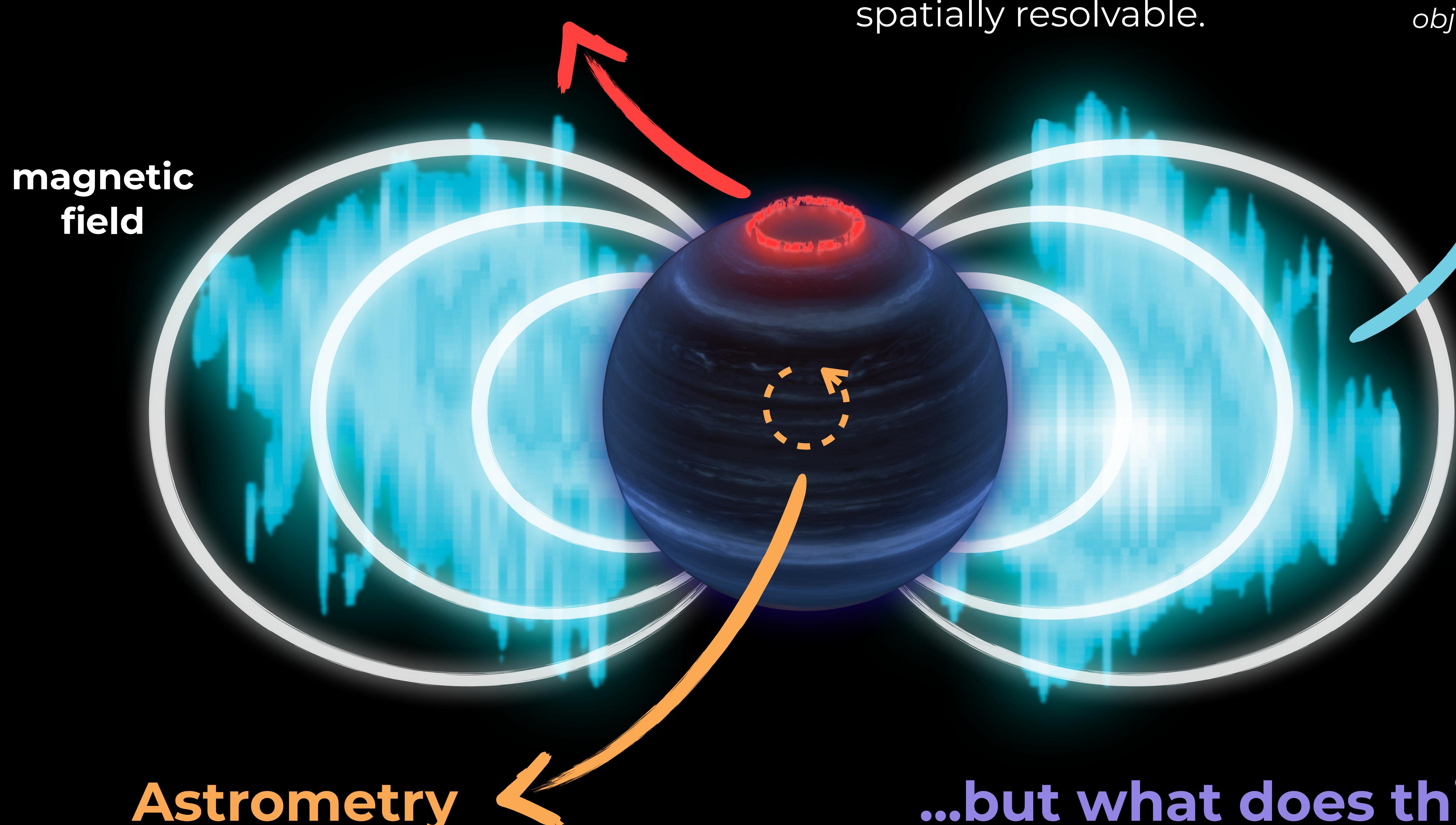
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## Aurorae

- ◆ Plasma incident on the magnetic fields of brown dwarfs (BDs) and exoplanets (EPs) can produce bright **circularly-polarised** radio emission, called an aurora.
- ◆ The frequency range of SKA-Low/Mid is **ideally suited for detecting aurorae** on BDs/EPs.

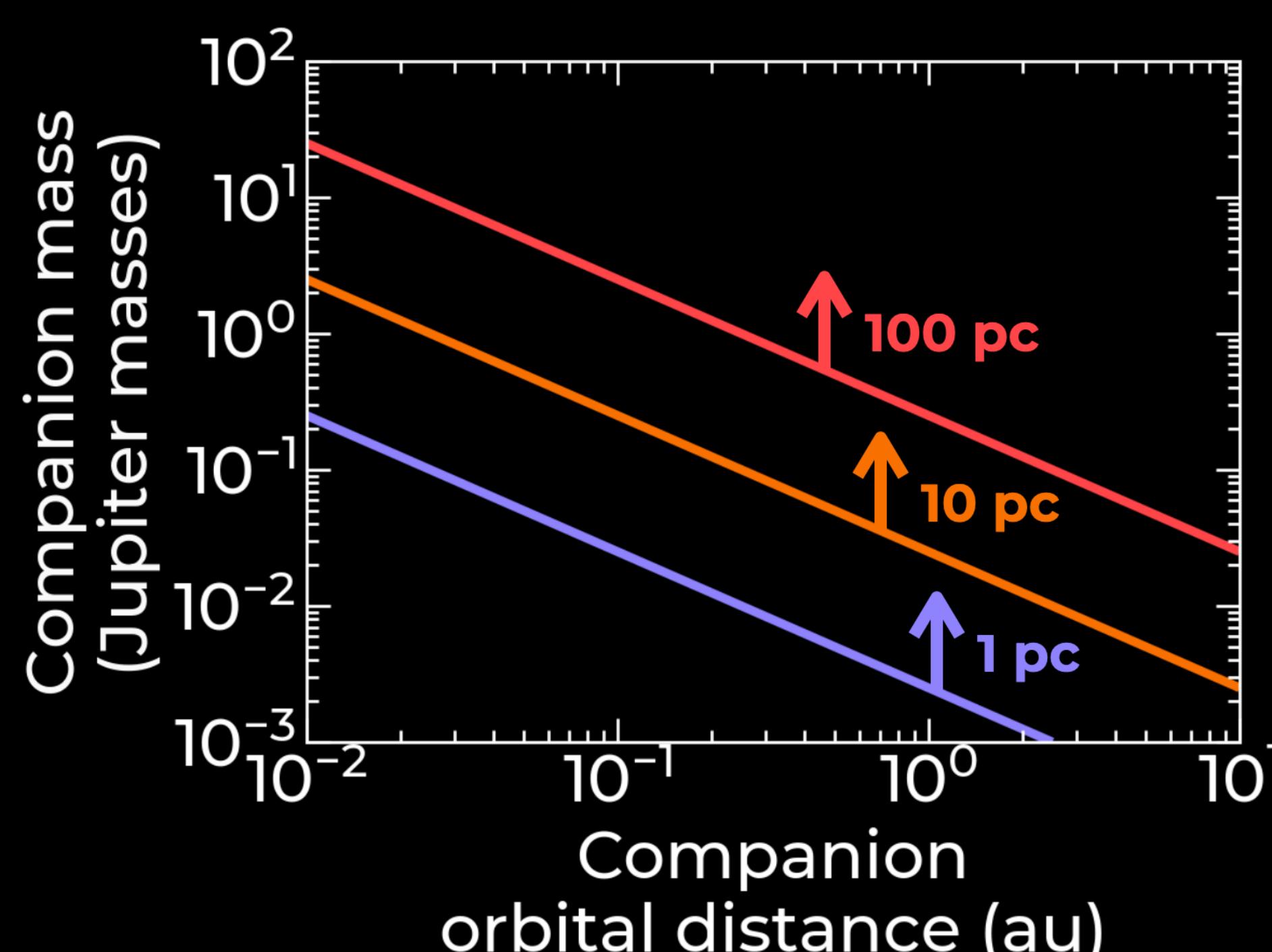


We estimate that aurorae can be detected on 200+ EPs with the SKA. Prospects are even more promising for BDs. Aurorae have already been detected on around ~20 BDs so far with current telescopes.



## Astrometry

- ◆ Unseen companions around radio-emitting BDs induce astrometric motion in their radio centroid.
- ◆ The  $\mu$ as precision of SKA-VLBI will enable the discovery of a **wide range of companions** around BDs:

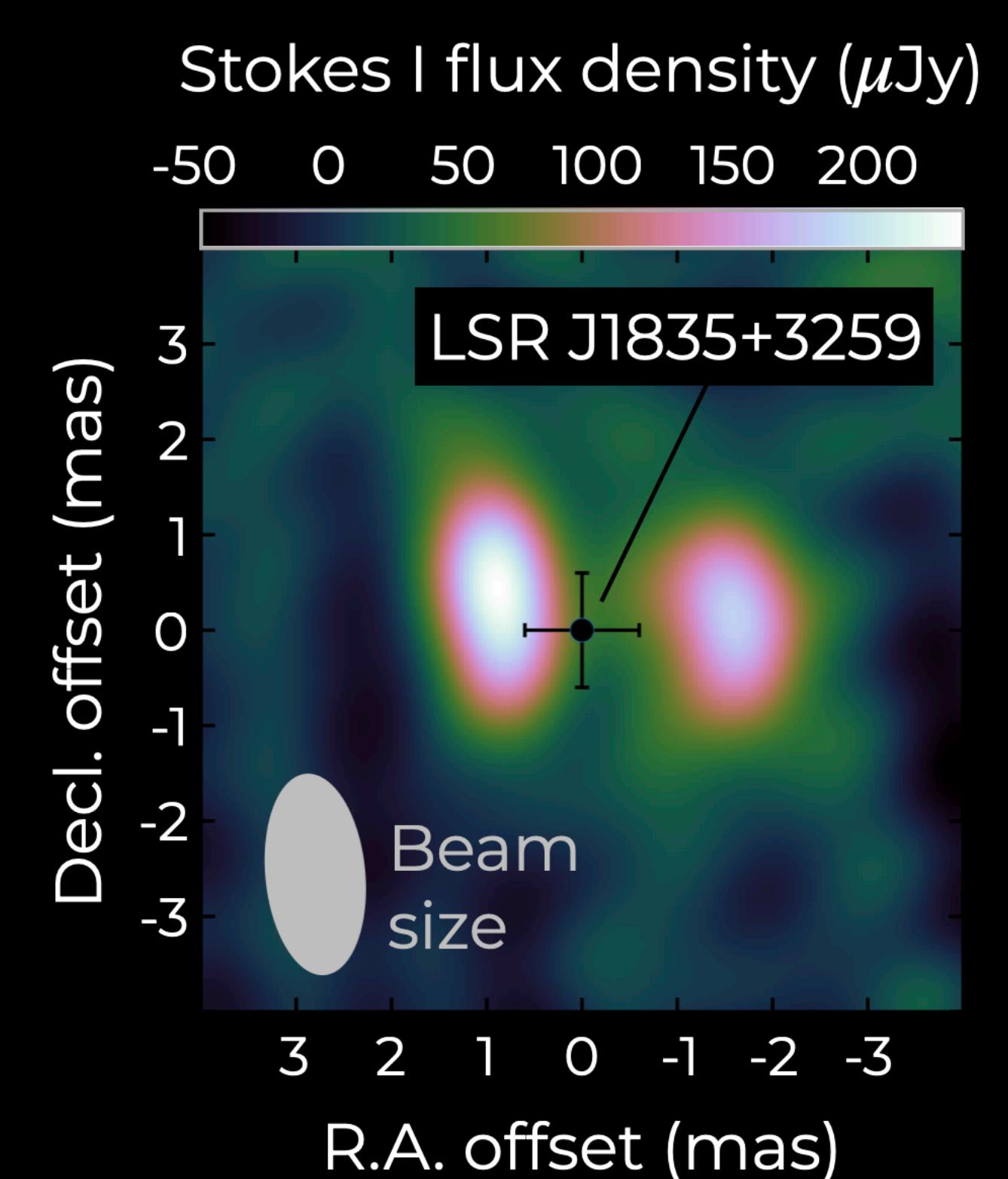


Companion properties measurable with SKA-VLBI for a 50 Jupiter-mass primary. Terrestrial-mass planets can be detected for close-by systems in  $\sim 1$  au orbits!

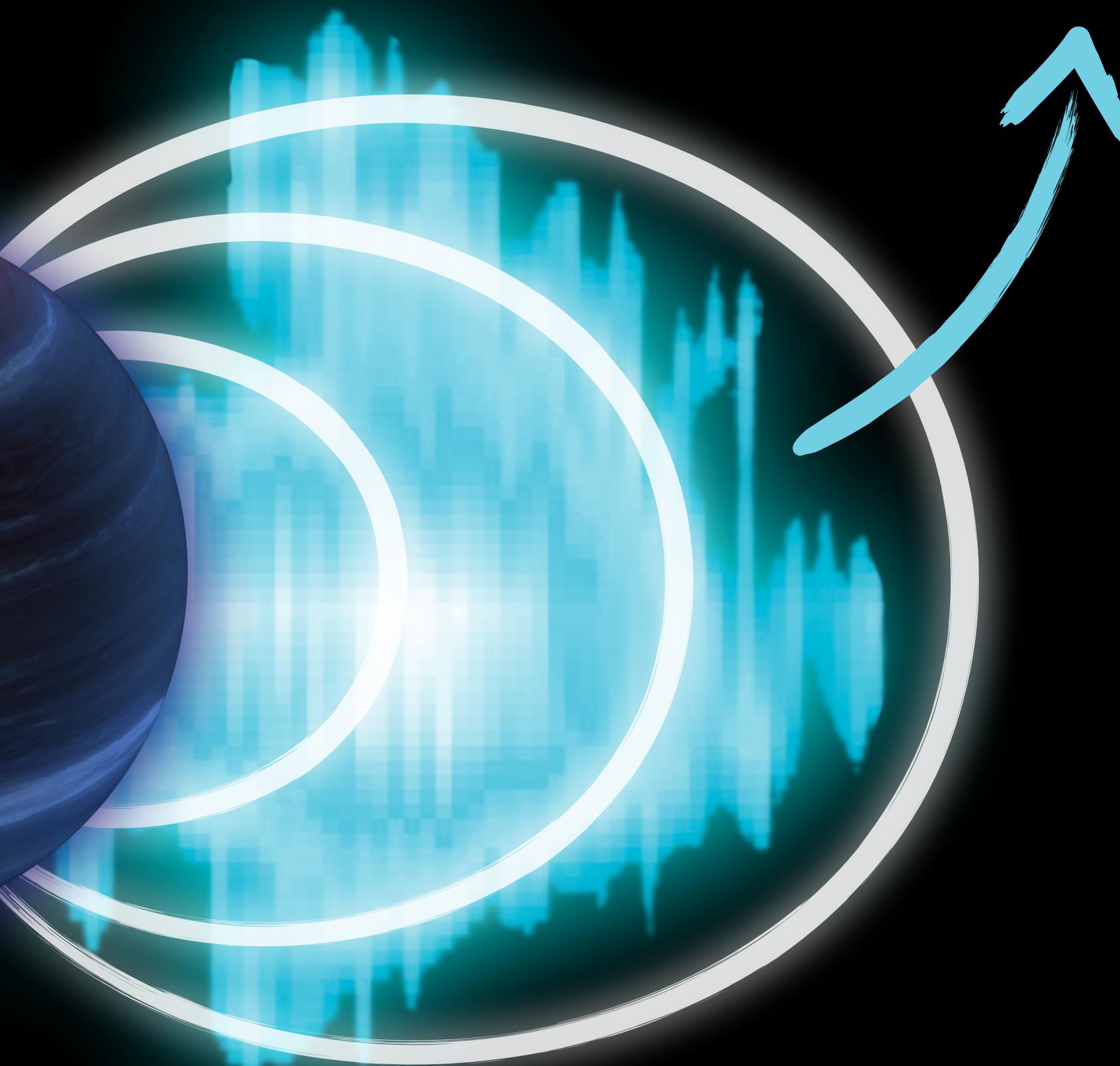
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## Radiation belts



Radiation belt imaged around the nearby BD LSR J1835+3259. The two bright lobes coincide with the magnetic field of the object (from Climent+ 2023).



BD image: L Hustak

## ...but what does this tell us?

- ◆ Auroral and radiation belt emission enable studies of BD/EP magnetic fields. This tells us about their **internal structure**, from which the magnetic field is generated.
- ◆ The demographics of wide-orbit EP/BDs from astrometry inform us about **formation pathways**.
- ◆ Magnetic fields are key to retaining planetary atmospheres – this provides insight into **atmospheric evolution**, and even the potential habitability of extrasolar worlds!

Full results to appear soon in the publication  
Advancing Astrophysics II (Kavanagh+ in prep.)

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