Post-RGB Planetary Nebulae

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At least 20% of PNe host a post-common-envelope central star, and theoretical considerations predict that a significant fraction of these should come from common envelopes during the RGB (as opposed to the AGB). However, only a handful of candidate post-RGB PNe are known. Here, we present the discovery of a new post-RGB binary central star - discovered as part of a concerted effort to discover and characterise binary central stars of planetary nebulae in order to further our understanding of the common-envelope phase.

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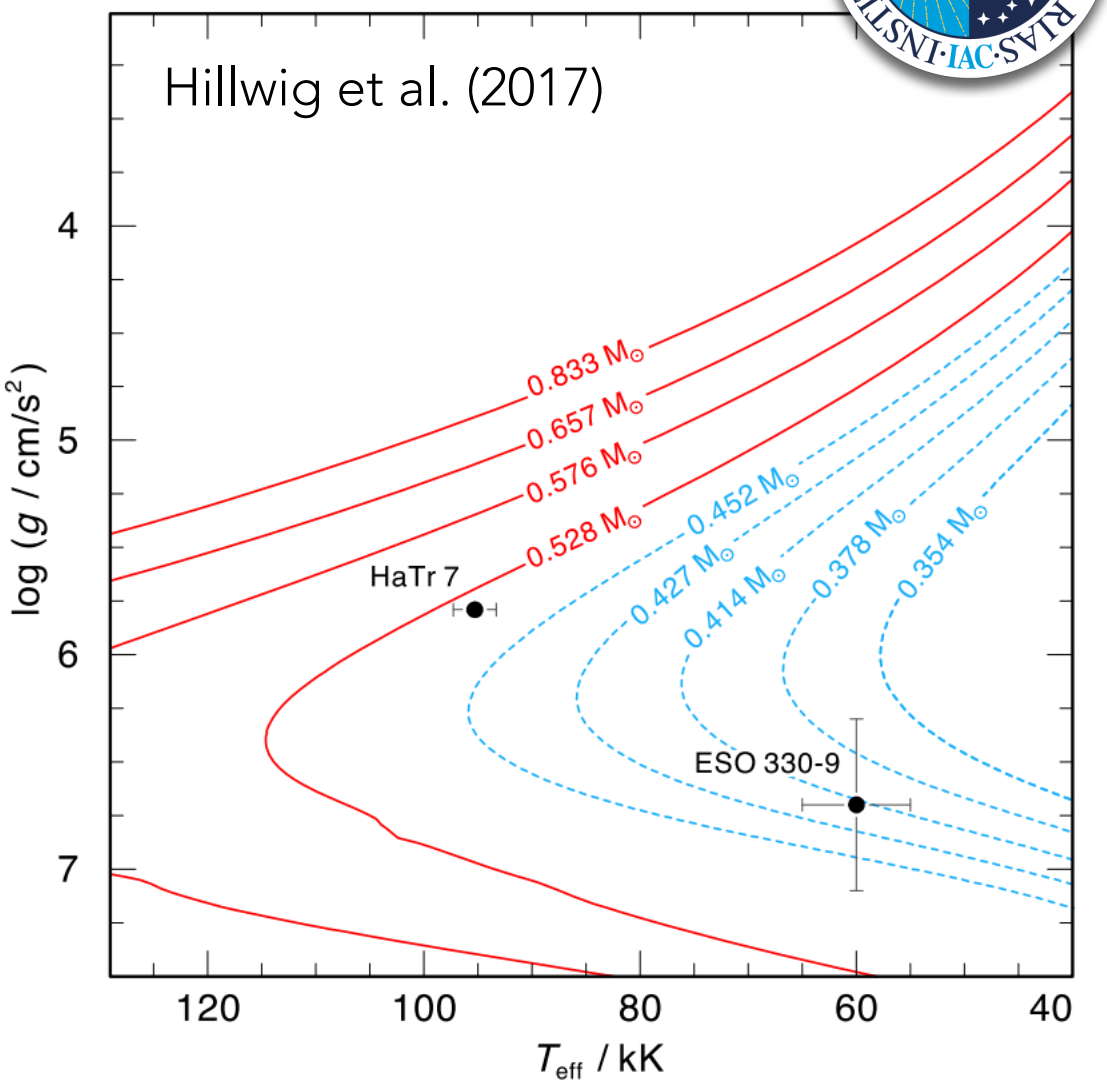
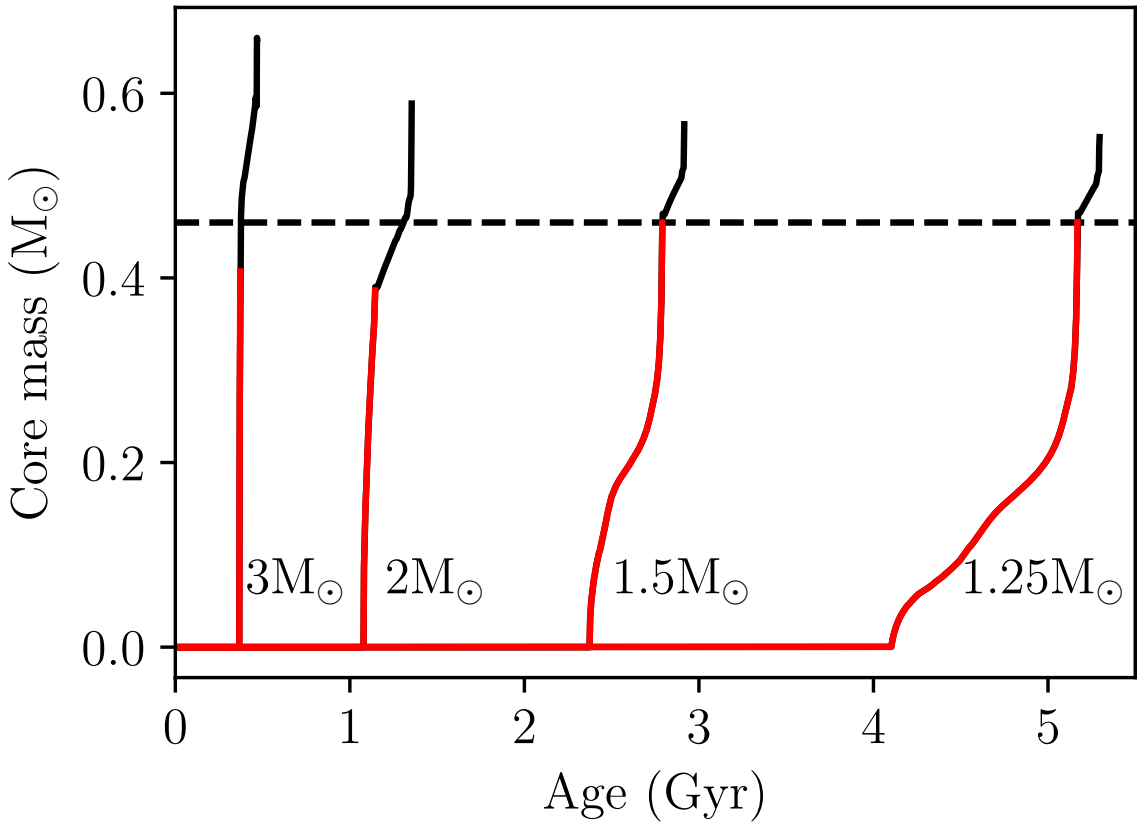
Where are they?

- The majority of post-common-envelope white dwarf + main sequence binaries are post-RGB (Rebassa-Mansergas et al. 2011)
- Many of these should have produced planetary nebulae (Hall et al. 2013)
- Only a handful of post-RGB PNe known



The mass is key

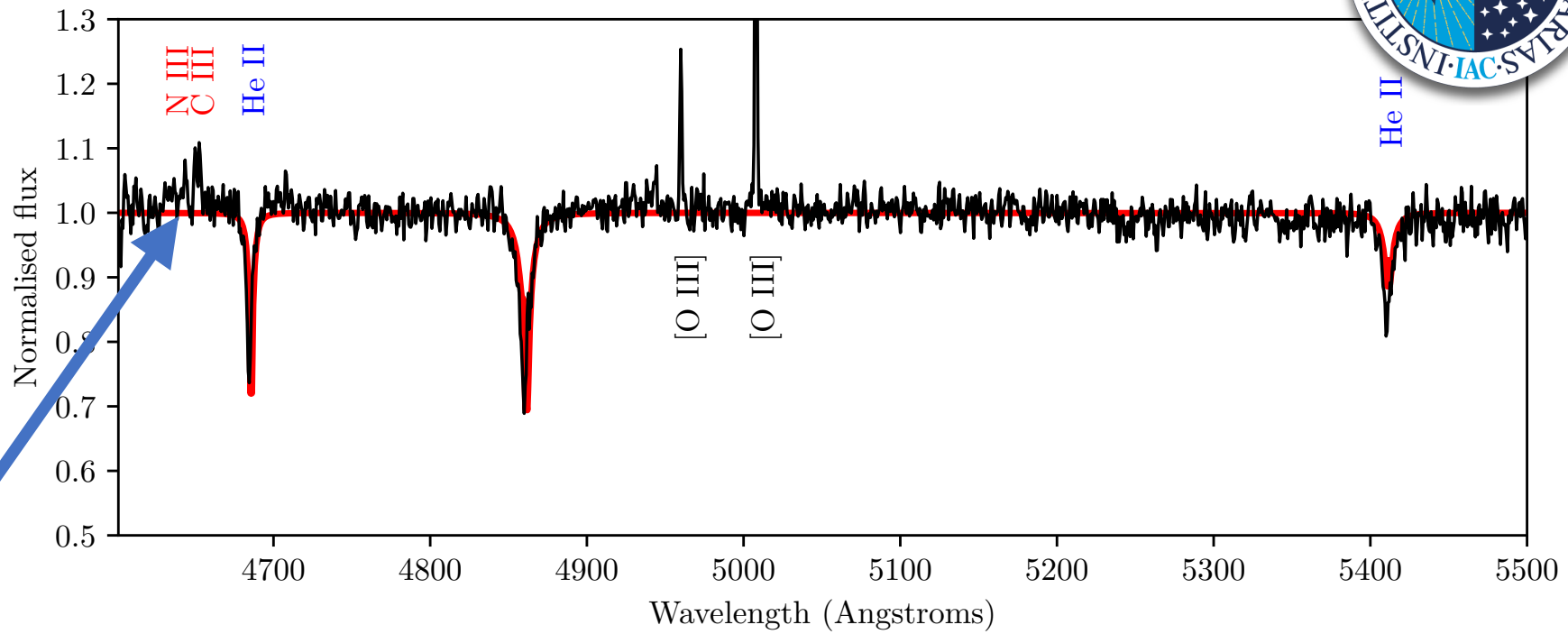
- Depends on initial mass, but maximum core mass on RGB is ~0.46Msol
- Any central star less massive must be post-RGB



So, how can we measure the mass?

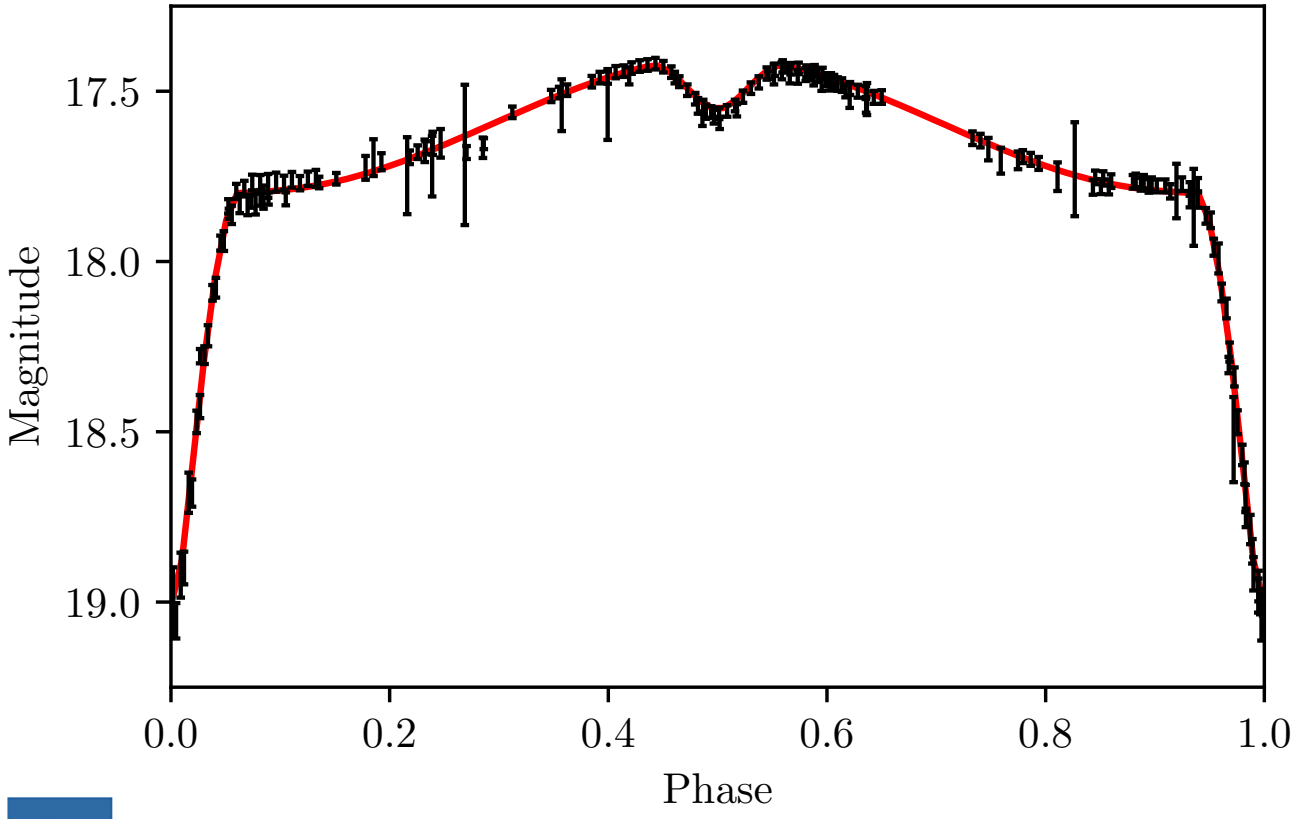
Masses are difficult!

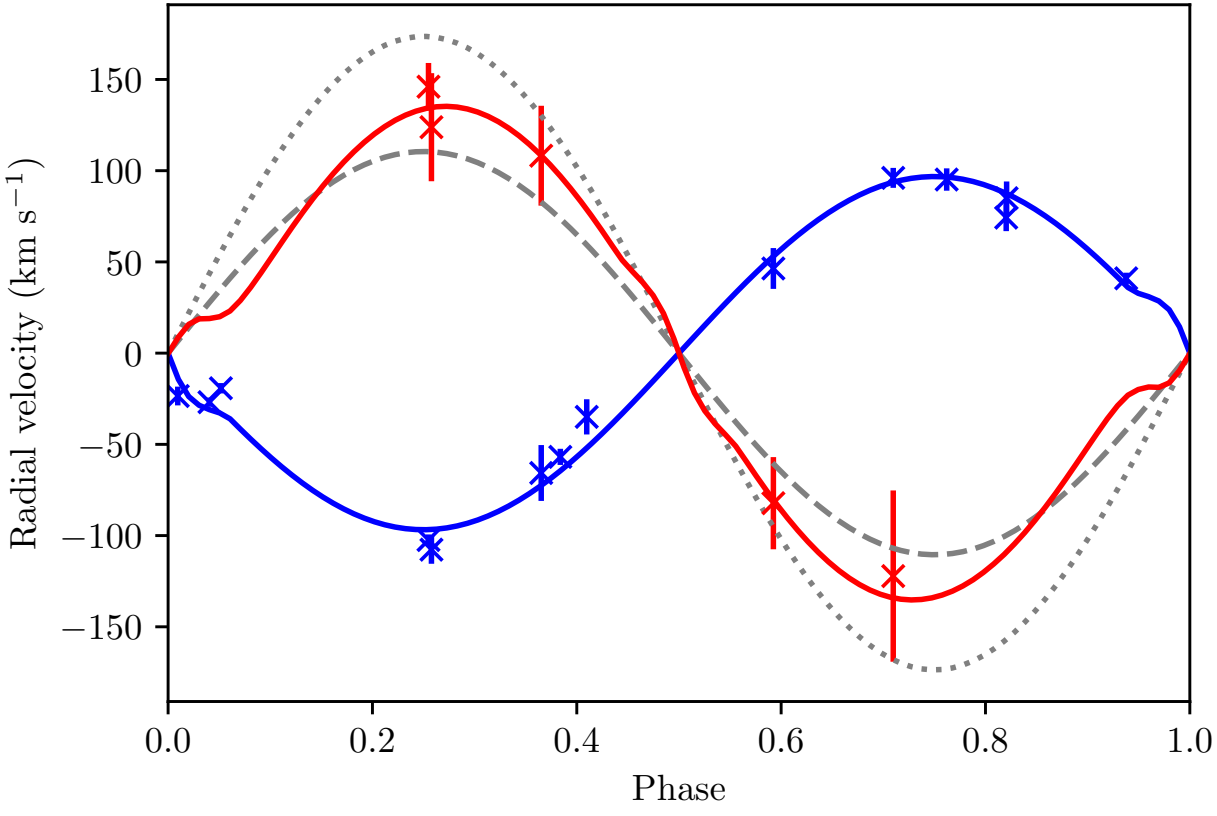
Remnant mass constrained by radial velocities of companion, which are measured using faint irradiated emission lines



Difficult to measure accurately, plus some uncertainty as to where they are produced on the companion

Simultaneous light and radial velocity curve modelling





Nevertheless, modelling can constrain the mass…

Post-RGB PNe +=1

- We have found a new post-RGB PN!
  - Central star mass ~0.35Msol (Jones et al. 2020, submitted)

- We now know of around 60 binary central stars, for most we only know their orbital period
  - Need more follow-up observations (especially radial velocities), in order to model them.
  - Faintness means 10m class telescopes

- Understanding the post-common-envelope population of PNe is critical to understand binary evolution in general!