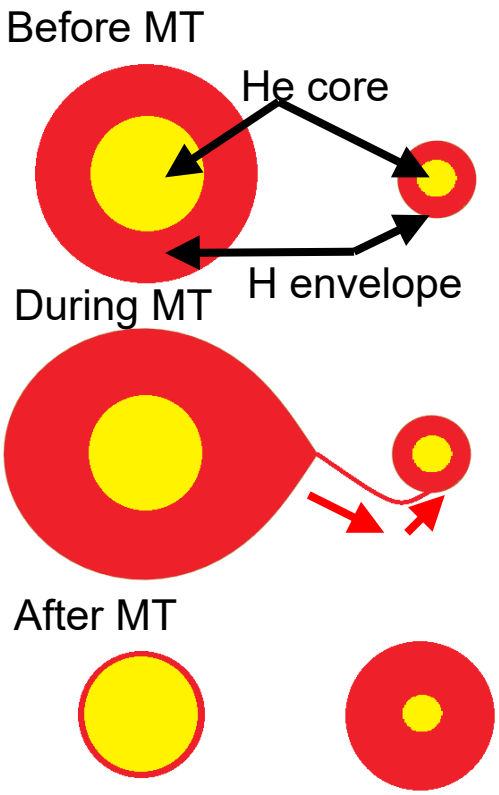
Asteroseismology of post Mass Transfer Red Clump stars

W.E. van Rossem, A. Miglio, J. Montalban

The aim of this project is to identify stars which have undergone binary interactions and measure the amount of Mass Transfer (MT) onto or off of these stars.

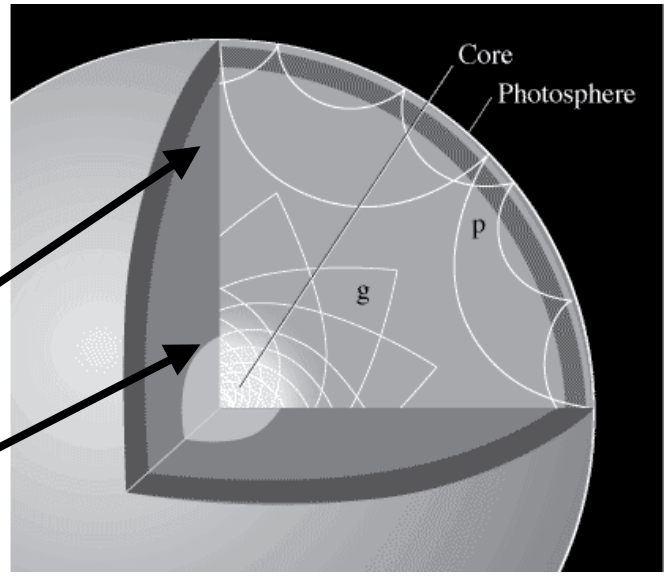


Mass transfer

- Significant effects on a star's structure.
- H envelope of a star can change greatly.
- He core remains around the same mass.
- How can we then identify such changes?

Asteroseismology

- Oscillations in stars.
- Two main types of oscillation
  - Pressure (p) modes
    - Probe outer layers
  - Gravity (g) modes
    - Probe inner layers
- Measures structure not directly observable through global properties like luminosity or temperature.



Two p modes and a g mode propagating through a star, reaching different layers inside the star [1].

[1] https://ase.tufts.edu/cosmos/view_picture.asp?id=897

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wev801@student.bham.ac.uk

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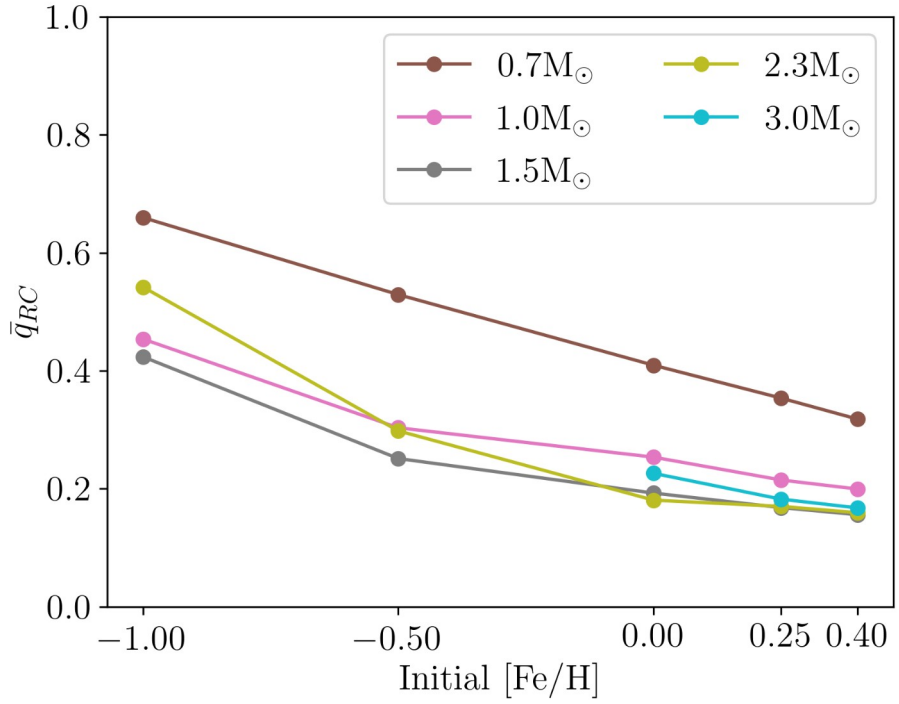
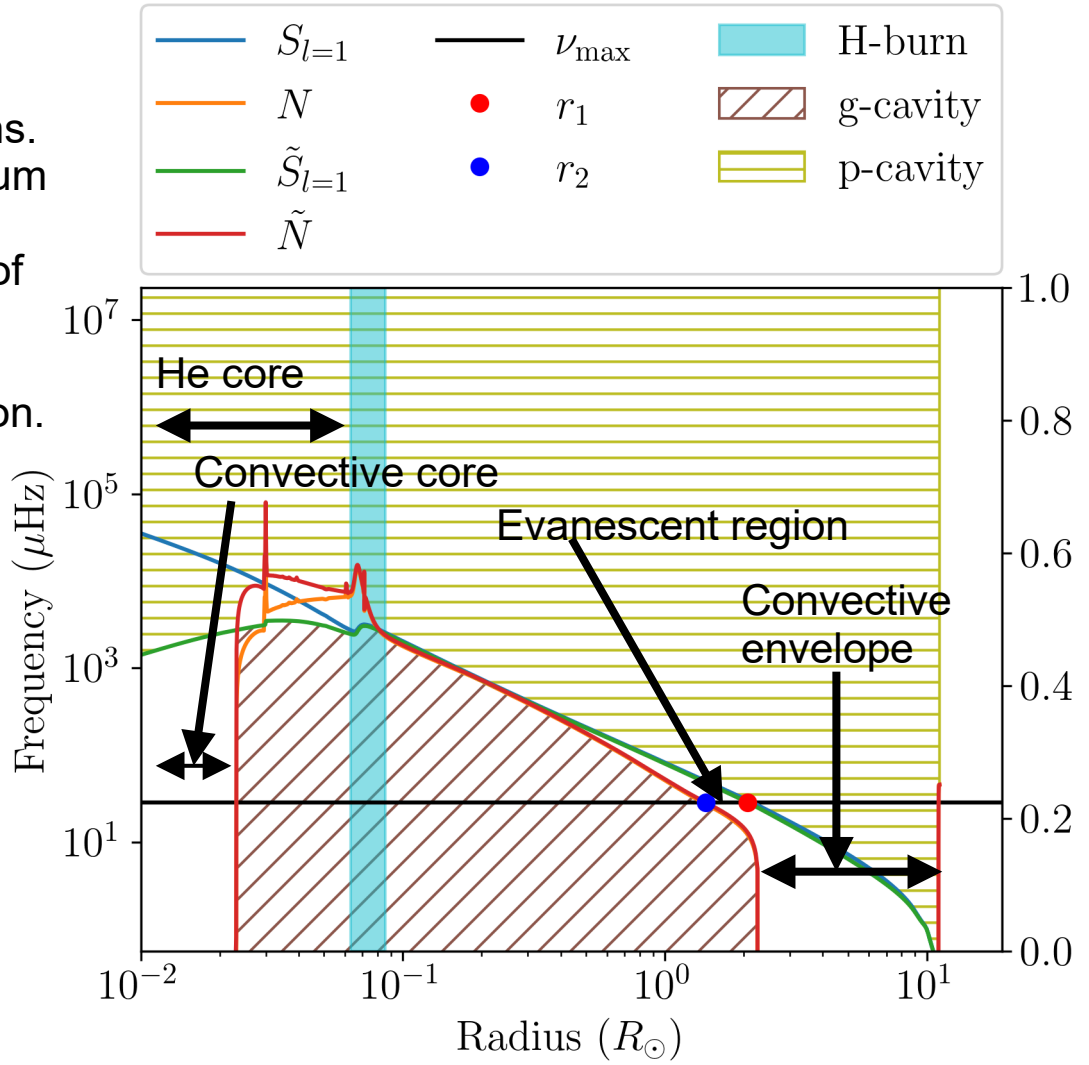
Mixed modes

- Mixture of p- & g-modes.
  - g-like in central regions, and p-like in outer regions.
- Typically found in stars in the Red Clump (core helium burning).
- Coupling coefficient *q* is a measure of the strength of character mixing.
  - defined by the evanescent region.
    - Stronger *q* caused by smaller evanescent region.
    - Also strongly metallicity dependent.





Structure of a star burning Helium in its core on the RC.

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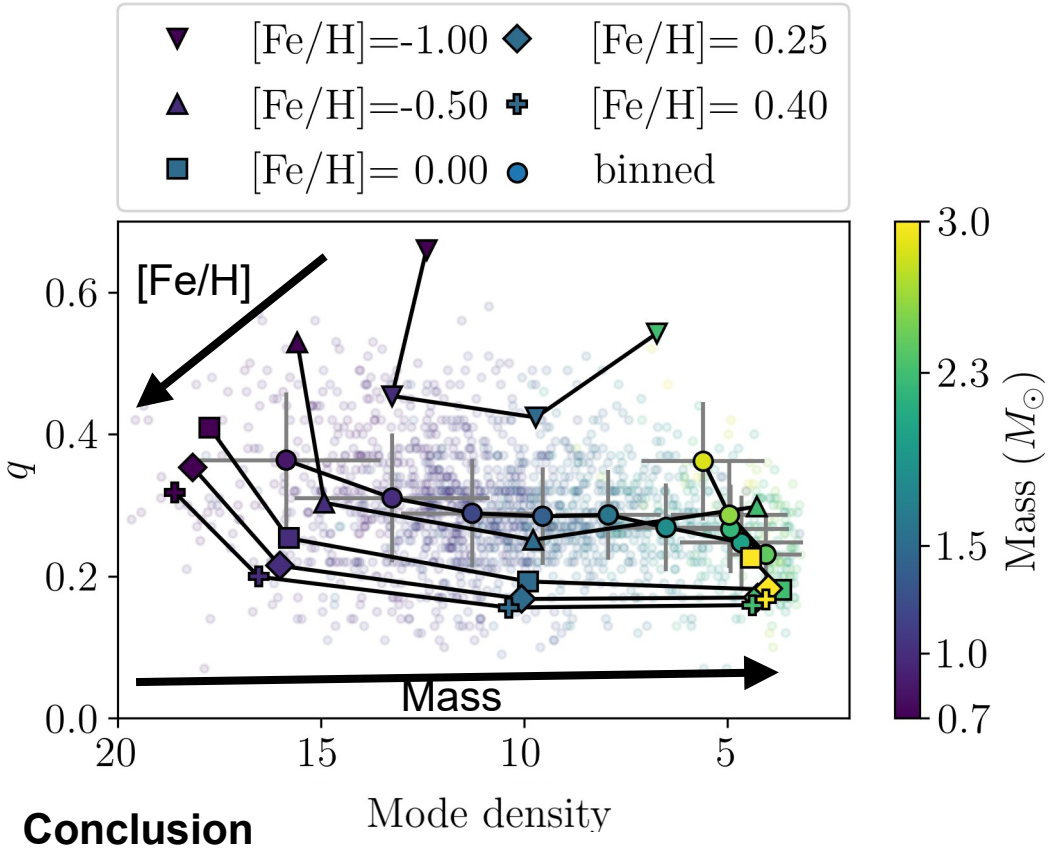
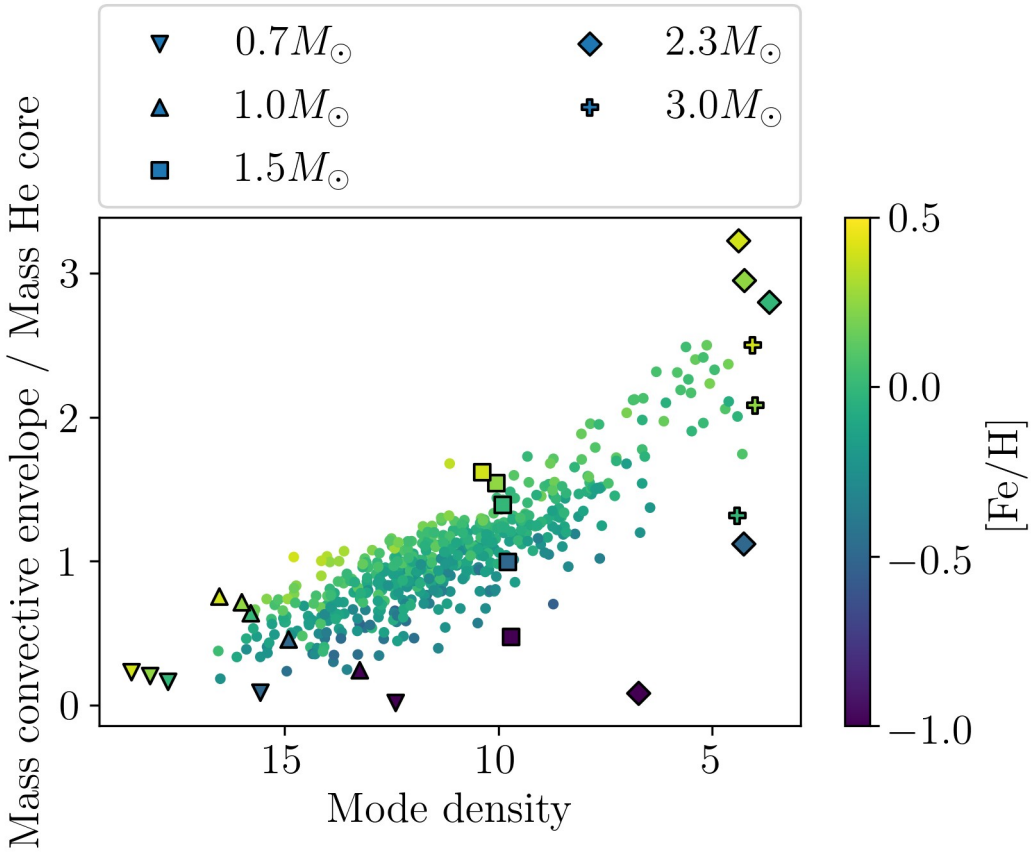


Results

- Model q and observed q follow same trends in metallicity and mass.
- Use q along with other global stellar properties to infer mass ratio of convective envelope and helium core.
  - Deviations from this relationship would then indicate the effects of MT.



Conclusion

- Mass transfer due to binarity can have significant effects on a star's structure.
- Asteroseismology is highly sensitive to the internal structure of stars.
- Effects of MT can in principle be measured using this work's method.
- This will allow for the accounting of binary effects on population studies
  - e.g. mass gainers that appear younger than they are and vice versa.

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