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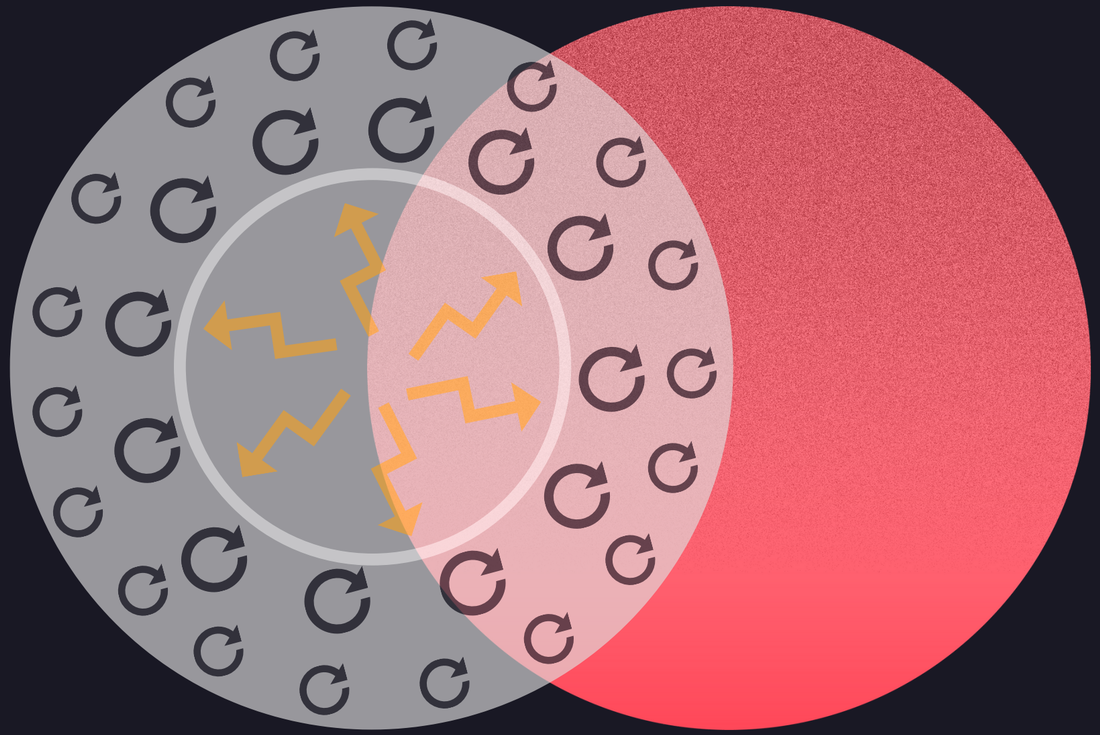
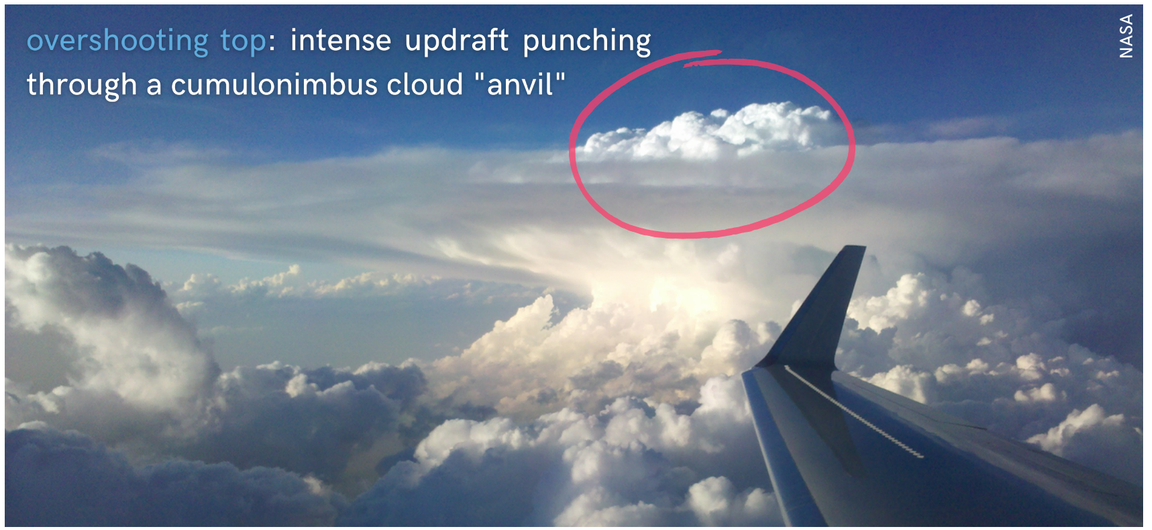
convection in low-mass stars

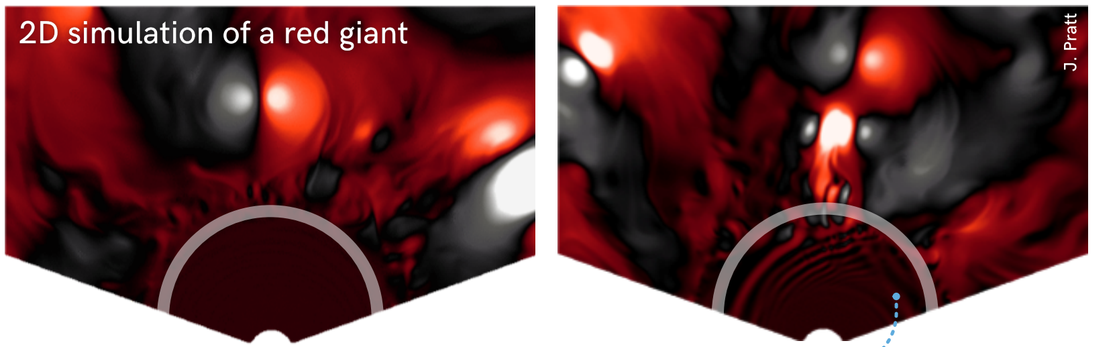


the treatment of convection* is a long-standing and crucial deficiency in our understanding of the evolution of low-mass stars

(*) macroscopic motions of matter that carry energy and constitute a very efficient mixing mechanism

however, the occurrence and efficiency of mixing processes beyond formal convective boundaries (overshooting) is poorly known





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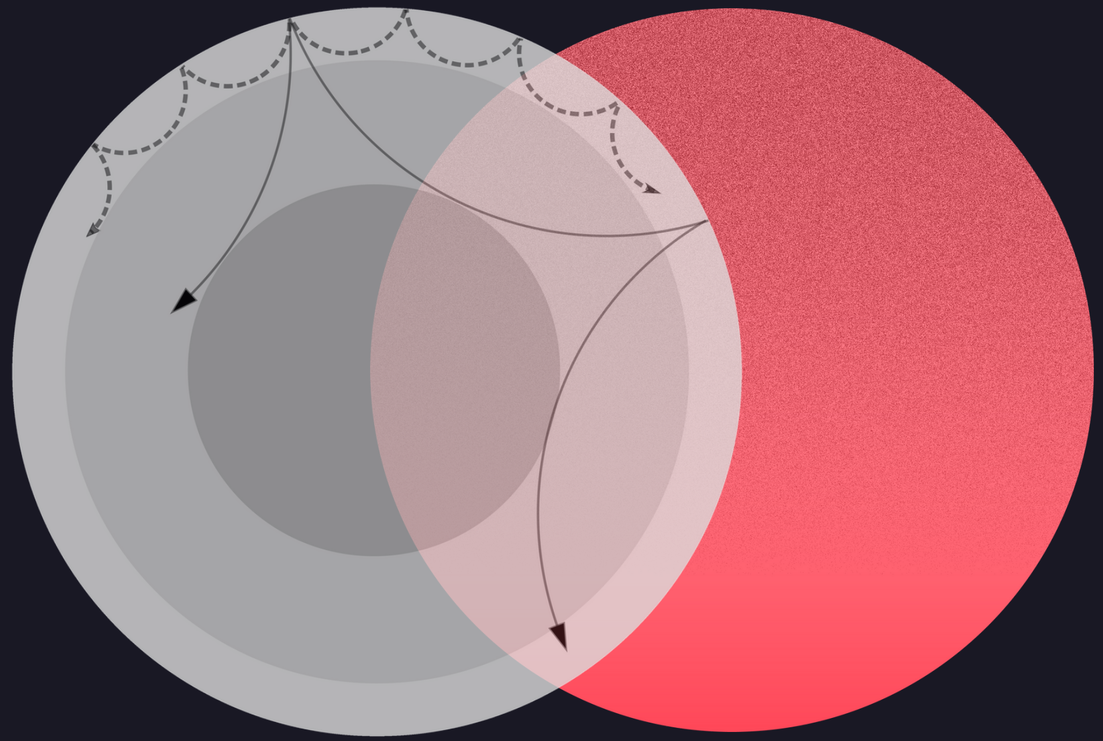
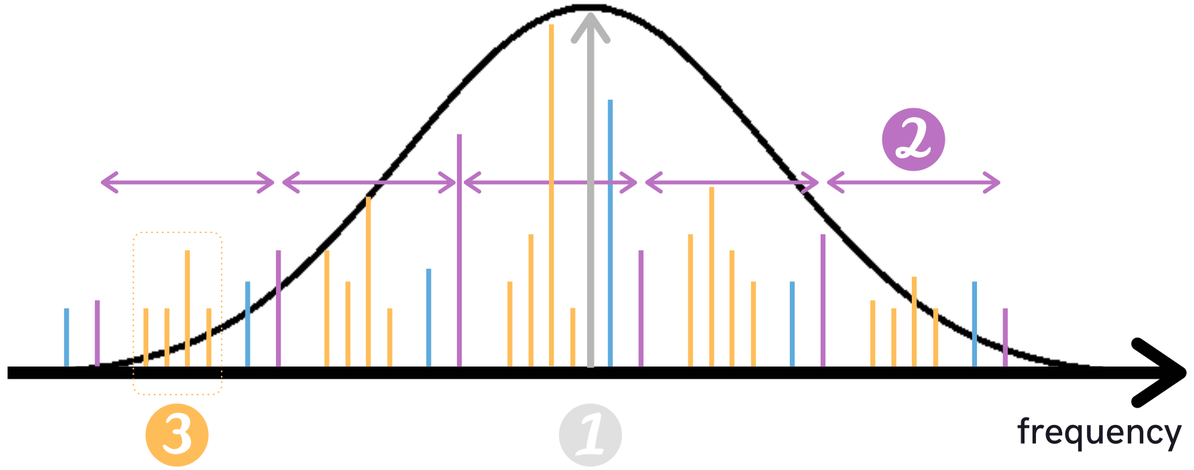
the "space photometry revolution"



asteroseismology - the study of stellar oscillations - allows us to probe the interior of stars, previously inaccessible from outer layers properties alone



the analysis of power spectra yields insightful information on stars:

- average spectral parameters (1, 2) can be related to fundamental stellar parameters
- individual frequencies (3) may provide direct constraints on variations in chemical composition in the stellar interior

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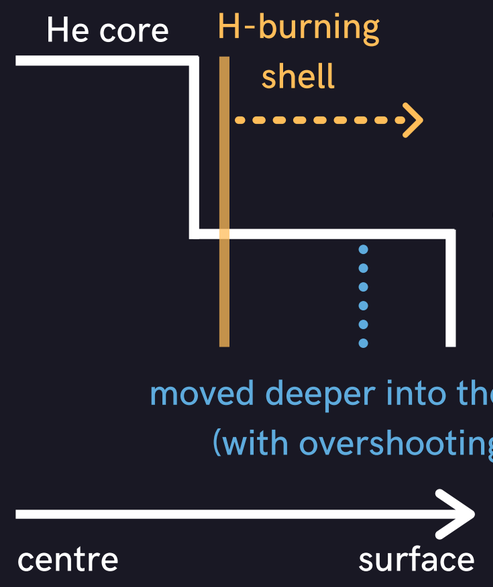
the red-giant branch bump (RGBb)

RGBb: temporary drop in luminosity as the star evolves on the RGB, as the shell approaches the chemical discontinuity



with the inclusion of overshooting, the discontinuity is met earlier by the shell, hence the RGBb has a fainter luminosity

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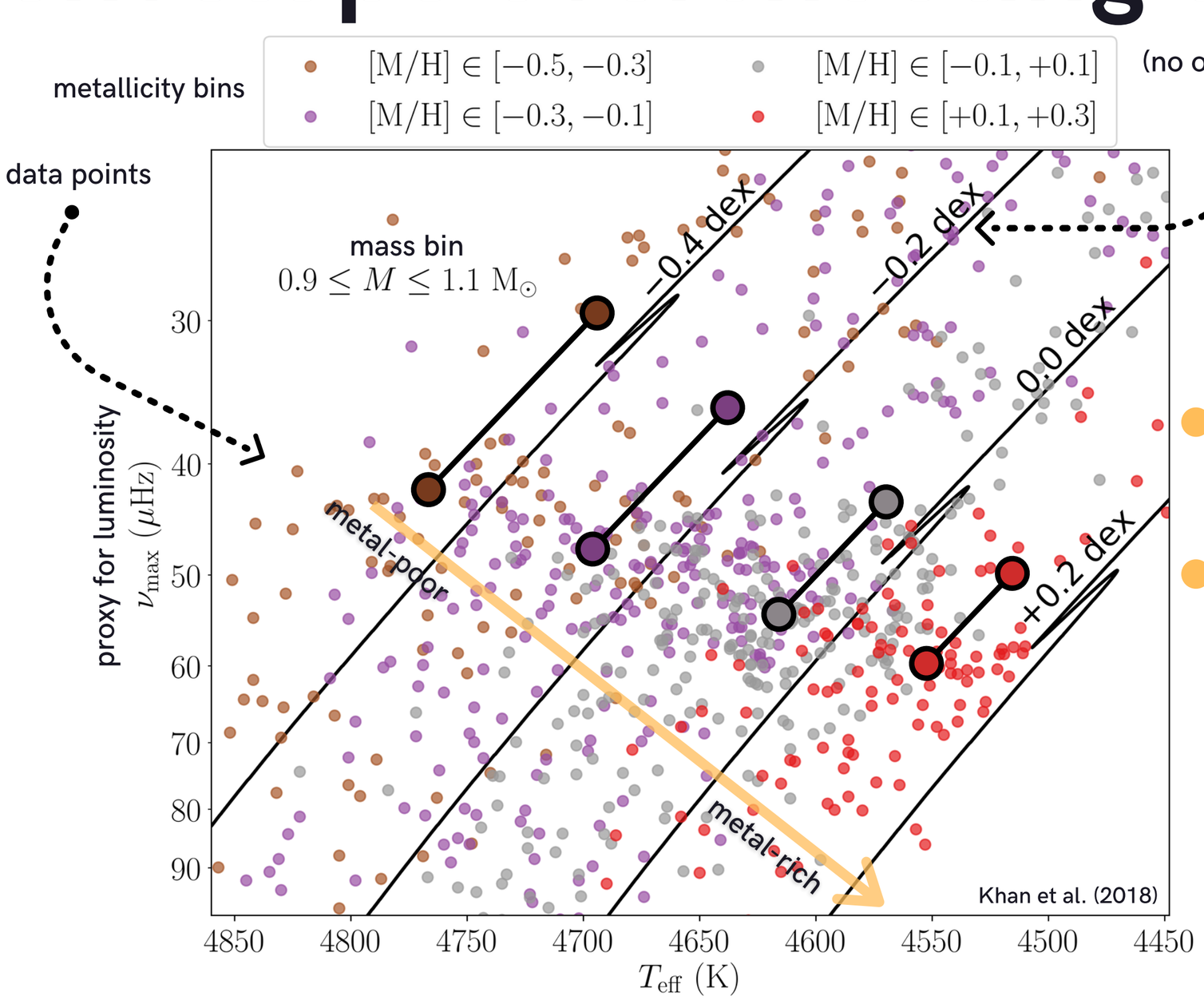
envelope overshooting calibration



Conclusions from asteroseismology + spectroscopy

- the inclusion of overshooting in the models (leading to a fainter RGBb) helps reproducing the observations
- for low-mass stars, the extra-mixing efficiency increases with decreasing [M/H]

Prospects

further constrain the RGBb using independent measurements and detailed asteroseismic diagnostics

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