Emulating stellar models with machine learning speeds up determining stellar masses, ages and radii

Hierarchically modelling *Kepler* dwarfs and subgiant stars to improve inference of stellar properties with asteroseismology

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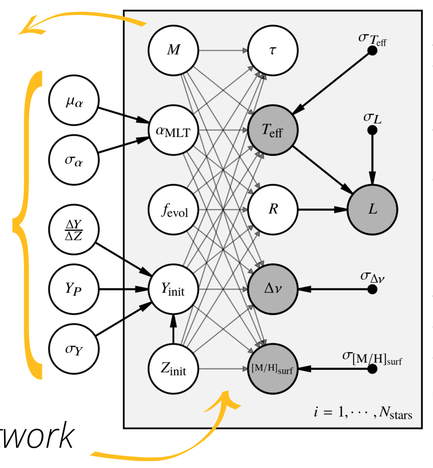
Intro

High-precision asteroseismology has improved estimates of stellar masses, ages,and radii, but has revealed systematics inpoorly constrained parameters like helium abundance (Y) and mixing-length theory parameter ($\alpha_{\rm MLT}$). We applied a hierarchical Bayesian model to enode population level information about Y and $\alpha_{\rm MLT}$ to improve the inference of stellar parameters.

Method

See Fig. 1 for sample of stars

Population-level parameters



Artificial neural network

Results

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Discussion

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Figures

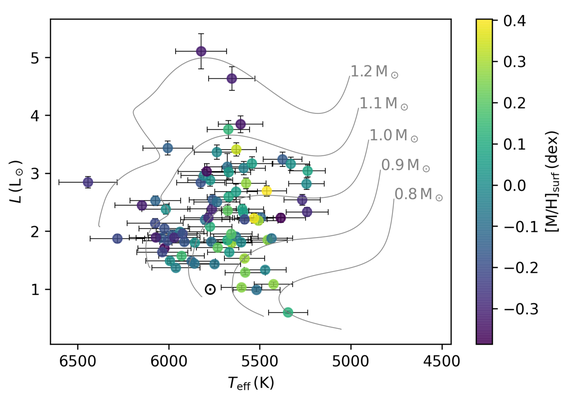

Fig 1. Hertzsprung-Russell diagram for thesample of 81 stars coloured by metallicity. The grey lines are evolutionary tracks for reference.

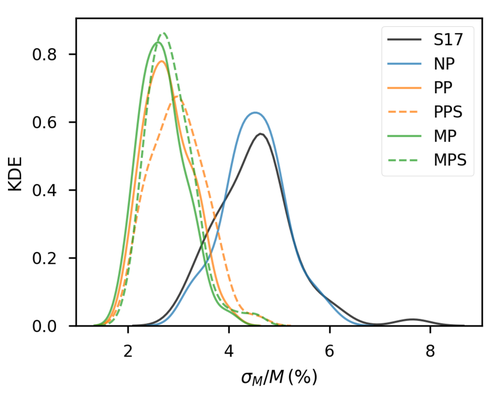

Fig 2. The statistical uncertainties of mass from Serenelli et al. (2017; black) compared to those from models in this work.

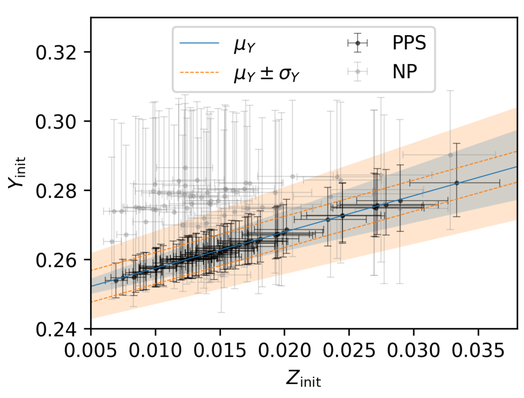

Fig 3. Initial helium abundance against initial metal abundance for the sample of stars. The non-hierarchical model results are in light grey and the hierarchical model results are in black.

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