Stellar Evolution & Pulsation (MESA+GYRE)

input: M [0.75-1.75]
Z_i [0.002-0.05]
Y_i [0.22-0.32]
α [1.0-3.0]

- evolve a model with specified input properties to an age that matches observational constraints
- initially this constraint is the mean large separation of consecutive radial mode frequencies $\Delta\nu_0$
- the final age must also match the lowest observed radial mode frequency, anchoring the fit
- the closest match to each observed frequency is selected from the final model for each degree
- frequency separation ratios (r010, r02, r13) are then constructed and compared to observations
- non-seismic properties (T_{eff}, [M/H], L/Lo, R/Ro) are also compared to available observations

output: Bayesian likelihood of the model

Parallel Genetic Algorithm (MPIKAIA)

- initialize with a random sampling of parameter values within the specified ranges
- 128 stellar models sampled for each iteration, 200 iterations to identify the optimal model
- master task: send parameter sets to slave jobs, gather results, genetic shuffling for next iteration
- slave task: receive parameter set, evaluate stellar model, return Bayesian likelihood to master
- master task records stellar properties and quality metric for each stellar model evaluated
- slave tasks run in parallel, from one per core (minimum) to one per node (maximum)