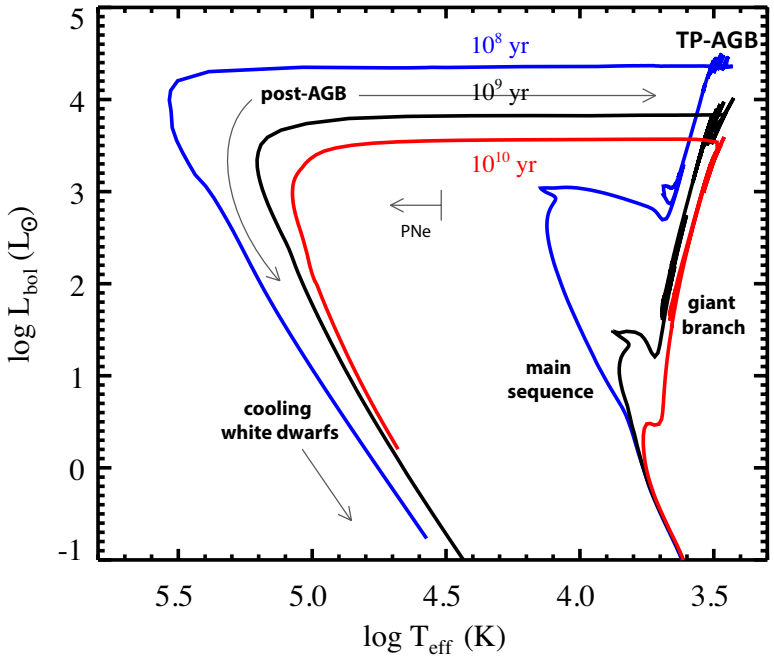
MIST

MESA Isochrones and Stellar Tracks



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in collaboration with: Aaron Dotter, Charlie Conroy, Matteo Cantiello, Bill Paxton

Why New Stellar Isochrones?

key diagnostic for age

tools to test stellar physics and stellar evolution

the backbone of stellar pop. synthesis models to study a wide range of extragalactic systems

lots of models to tackle specific problems, but a coherent, large set of models also important (also see Leo G.'s talk re: PARSEC models from Mon.)

Why New Stellar Isochrones?

key diagnostic for age

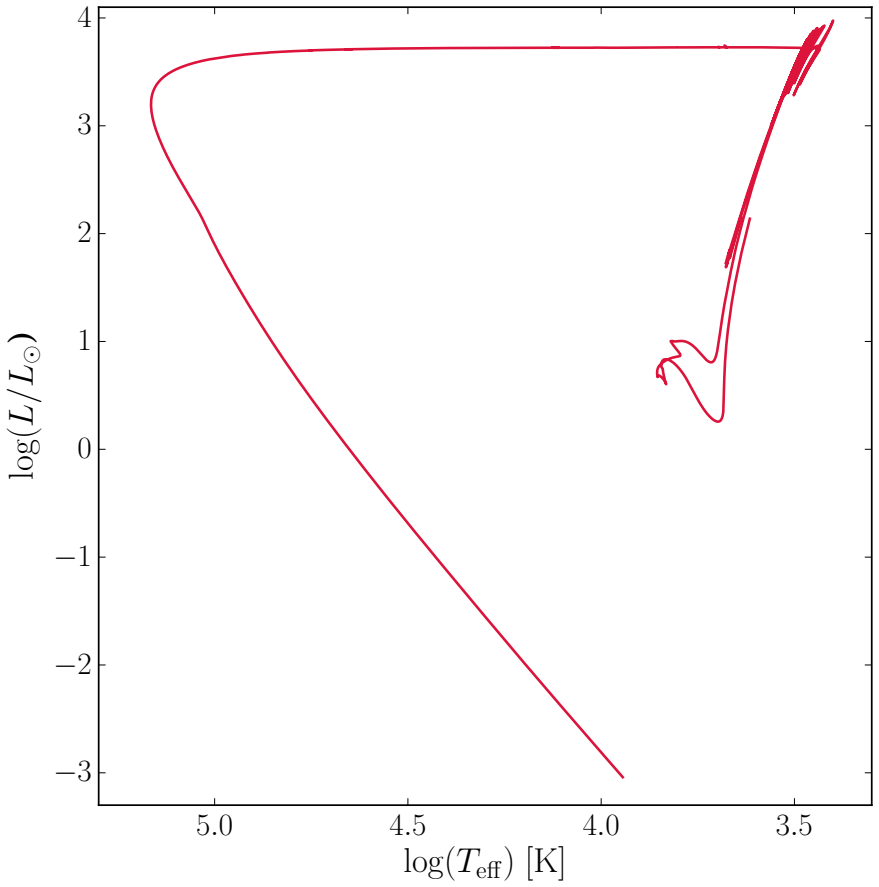
aim: a self-consistent set of models that cover a wide range of masses, ages, and phases for a variety of metallicities and abundance patterns

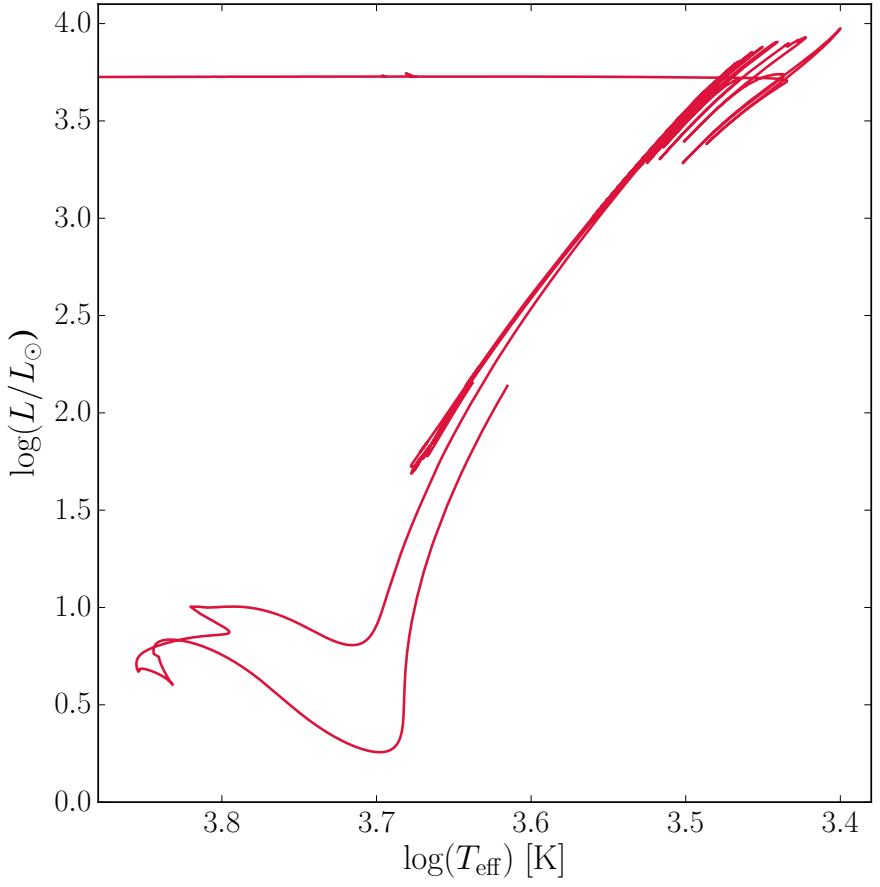
set of models also important (also see Leo G.'s talk re: PARSEC models from Mon.)

Example: 1.5 $M_\odot$ Evolution

Paxton+11,13

preMS → MS → RGB → He core flash → core He burning → AGB → postAGB → WDCS





MIST models: 1st release

solar-scaled abundances adopting Asplund+ 09

$-7.0 \leq [Fe/H] \leq 0.5$

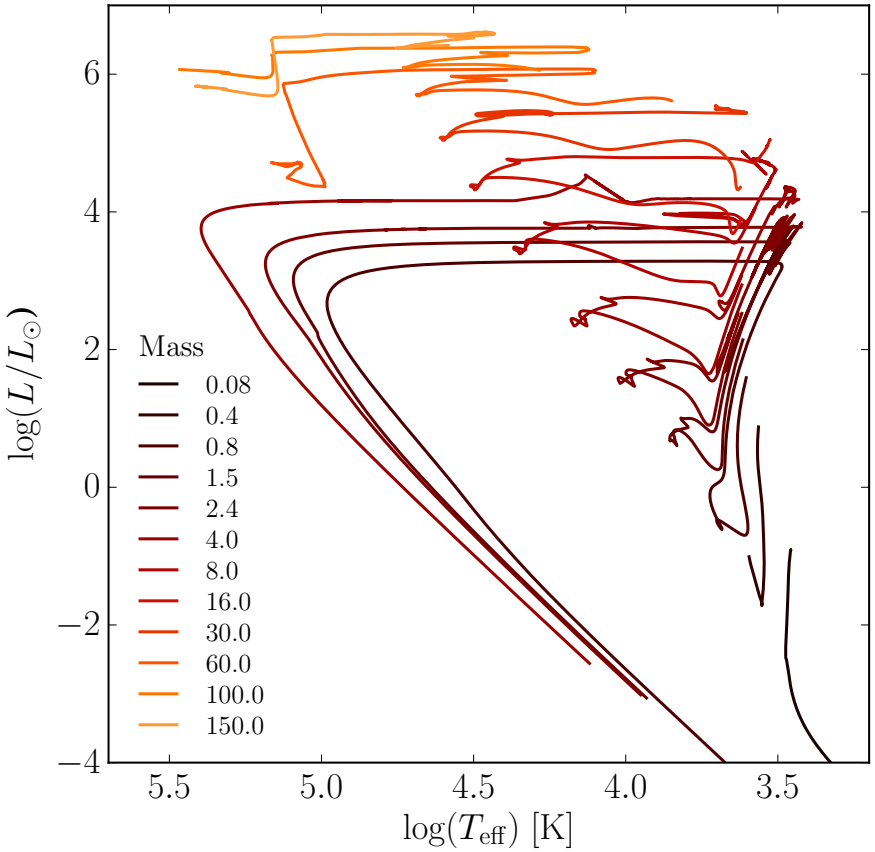
$5.0 \leq \log(Age) \leq 10.3$

$0.1 \leq M \leq 150$ (100+ masses per metallicity point)

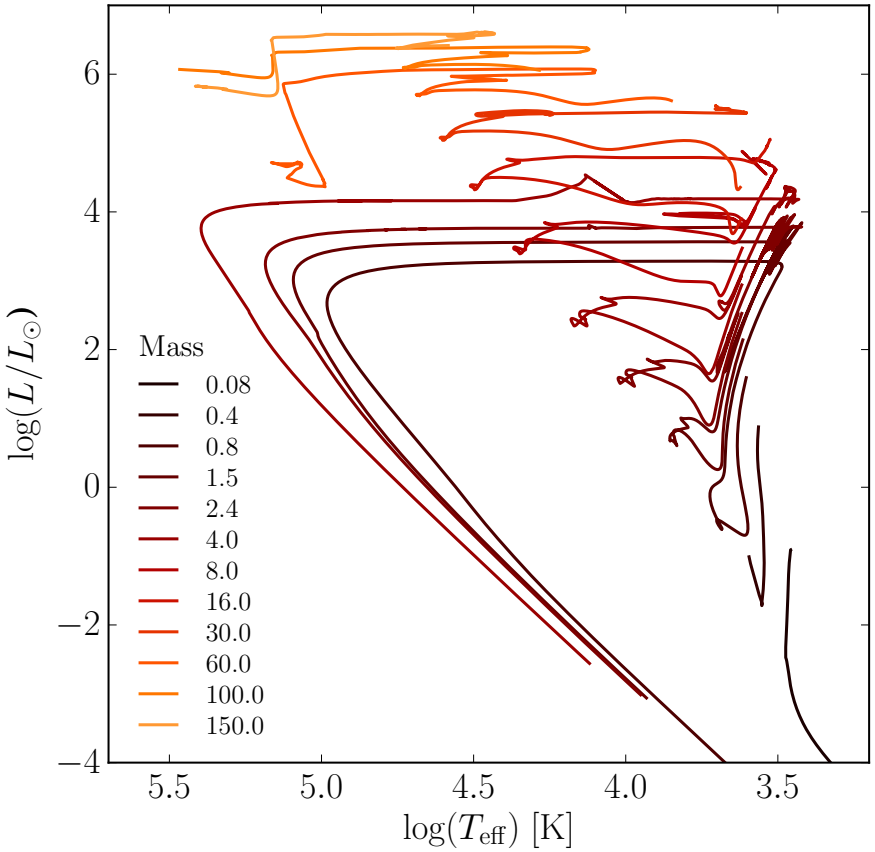
continuously and self-consistently modeled from the preMS to advanced phases, e.g., WDCS and C-burning

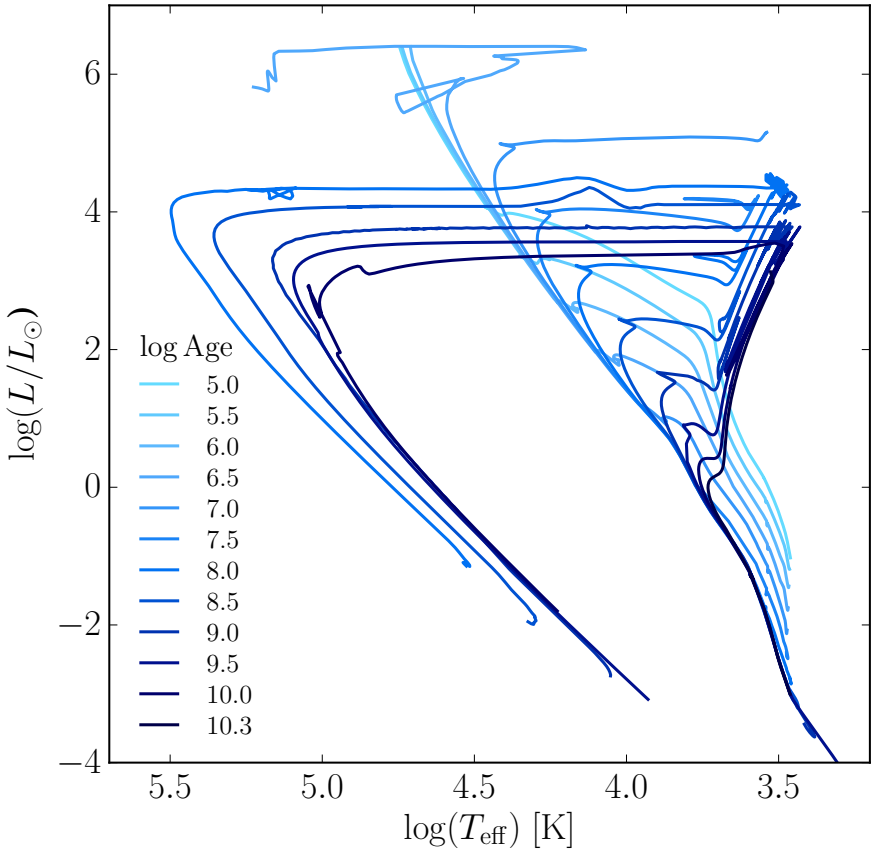
with and without rotation ($v/v_{crit}=0.4$)

Solar Z Tracks and Isochrones



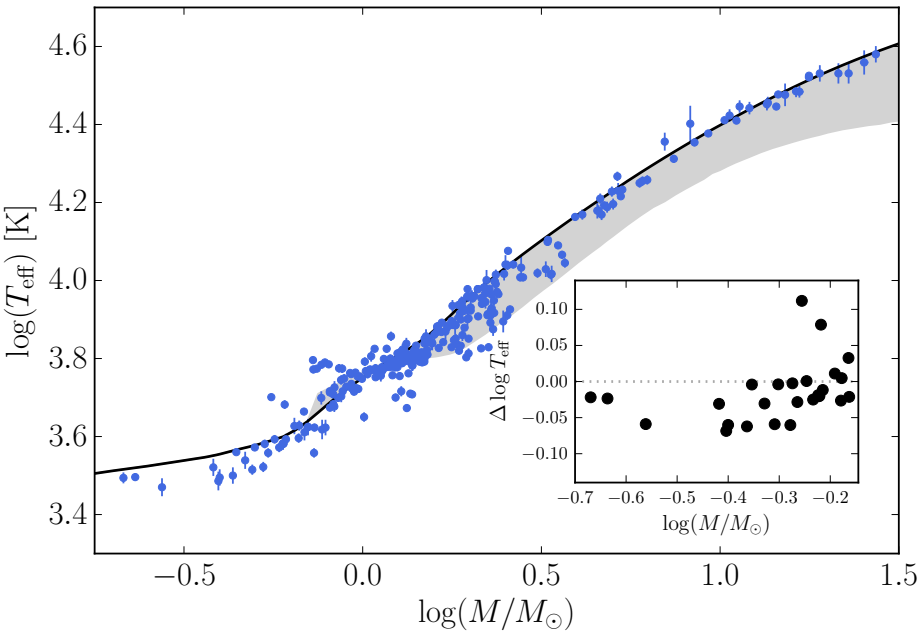
Solar Z Tracks and Isochrones

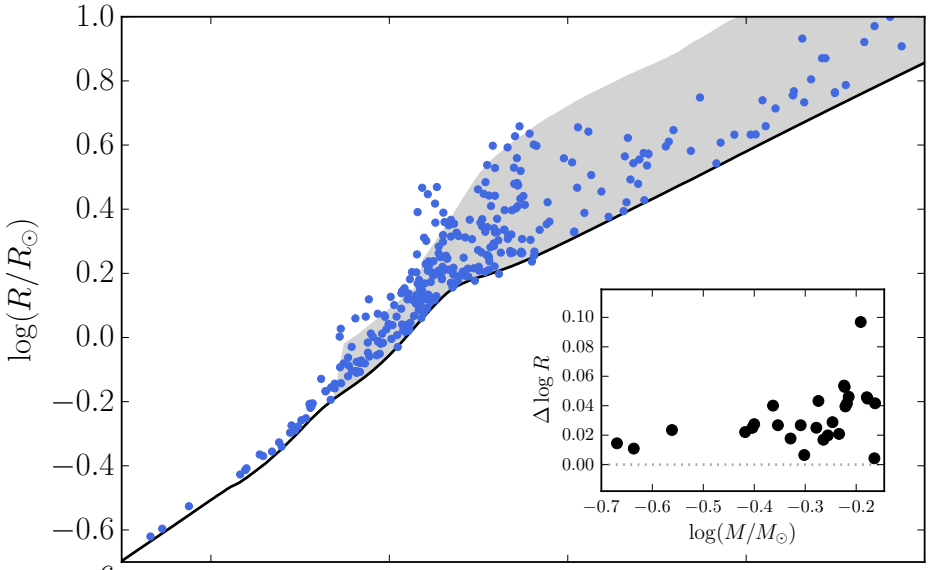


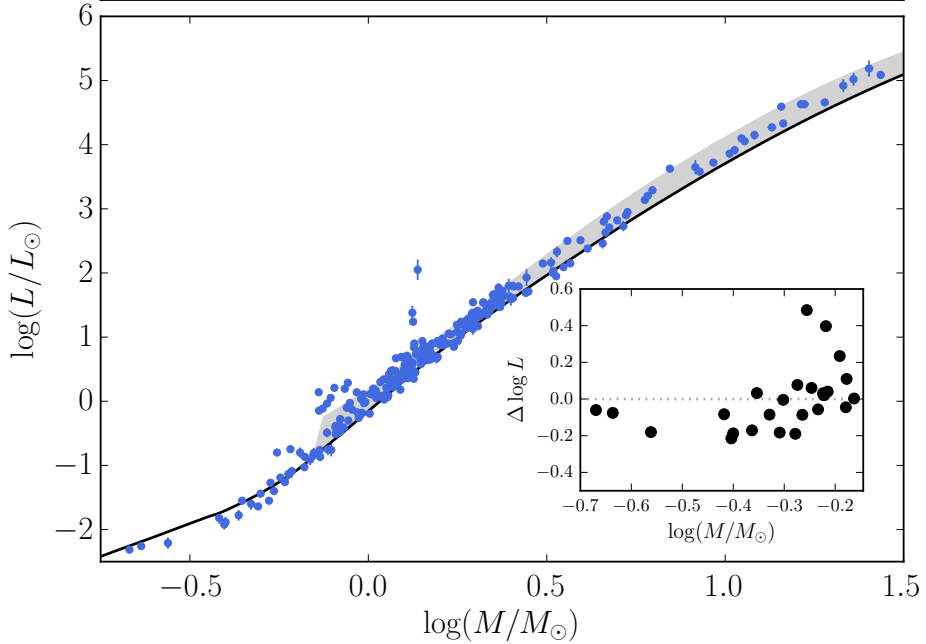


M-R-L-T_{eff} Relations

stellar properties from
detached eclipsing binaries
(DEBCat; Southworth14)







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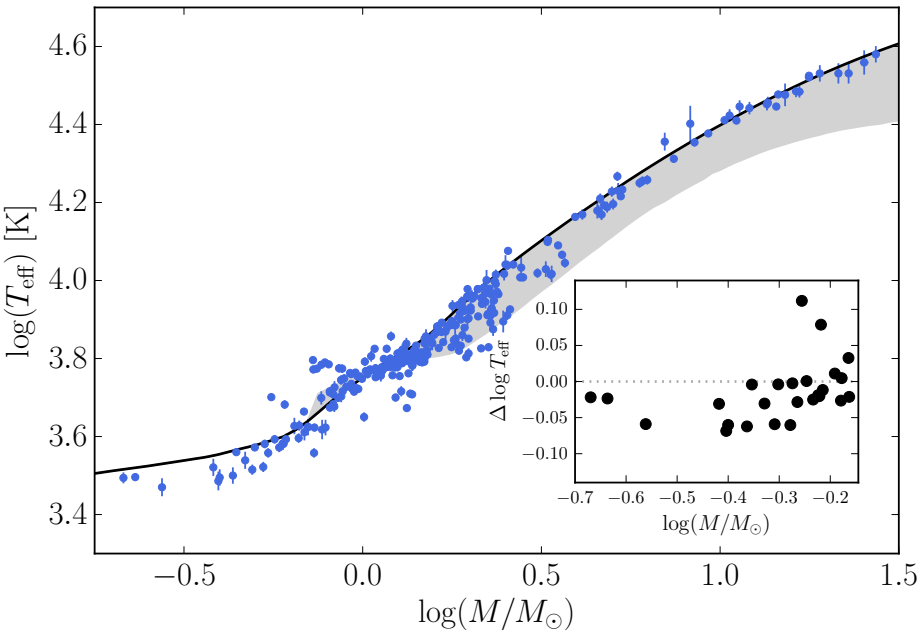
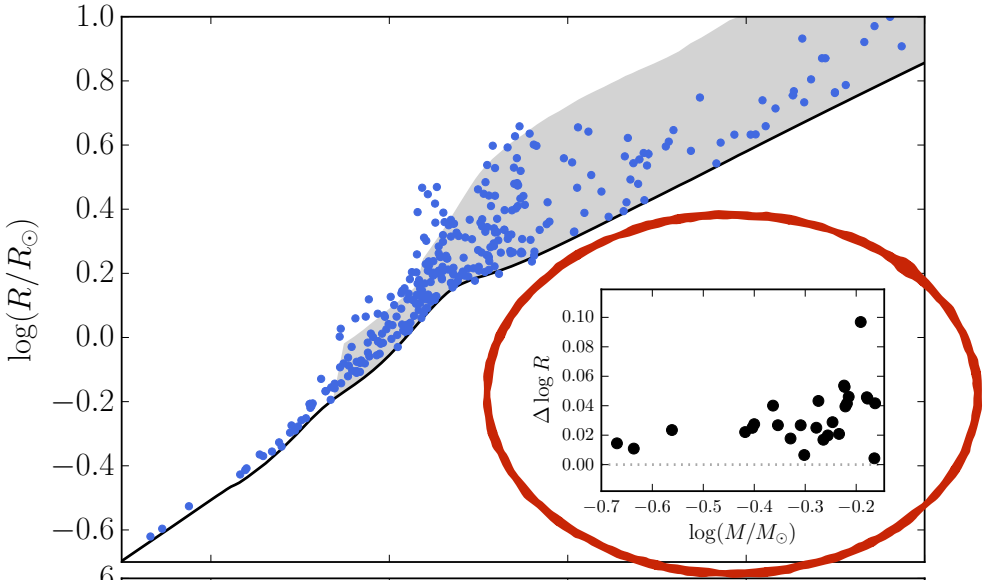
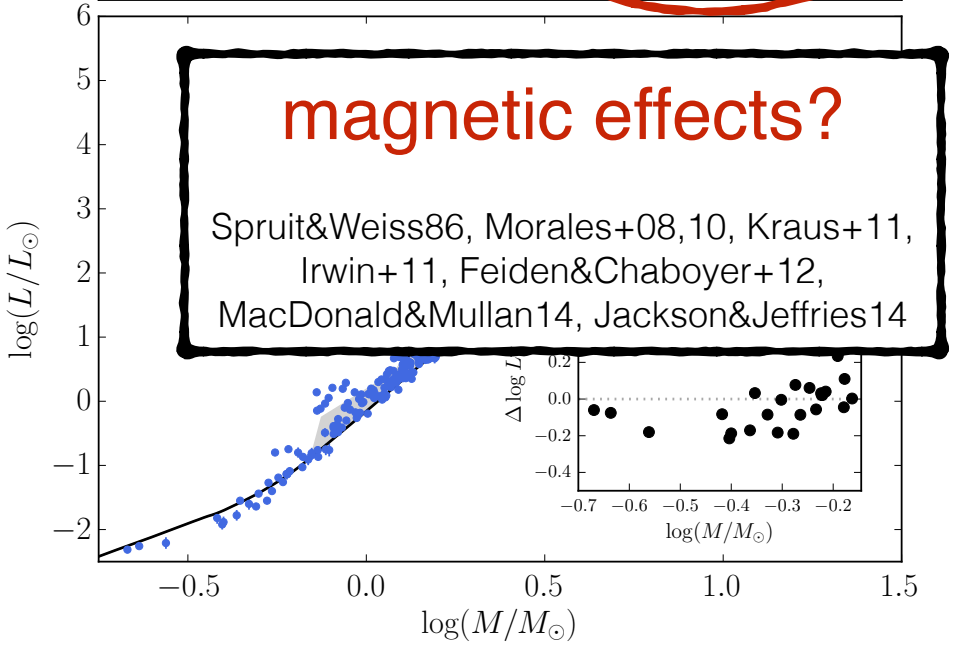


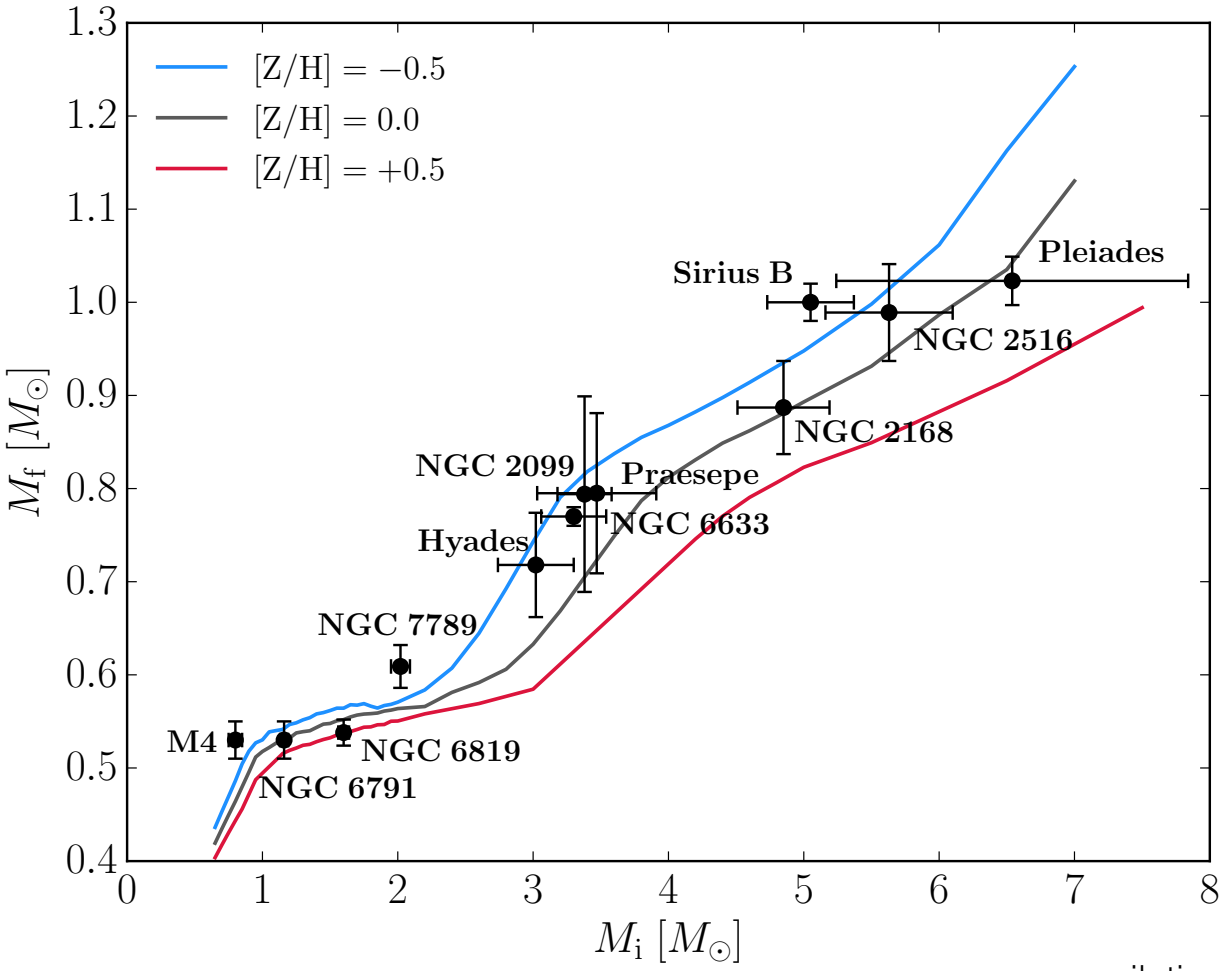




magnetic effects?

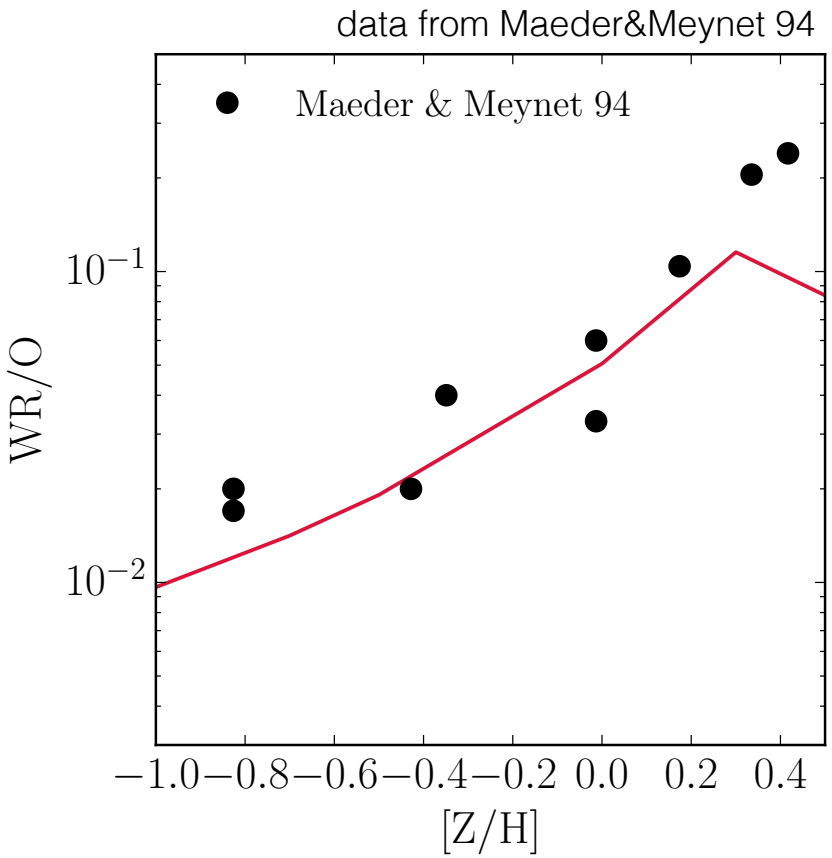
Spruit&Weiss86, Morales+08,10, Kraus+11,
Irwin+11, Feiden&Chaboyer+12,
MacDonald&Mullan14, Jackson&Jeffries14

Initial-Final Mass Relation



compilation of data from the literature
courtesy of J. Kalirai

High Mass Star Lifetimes



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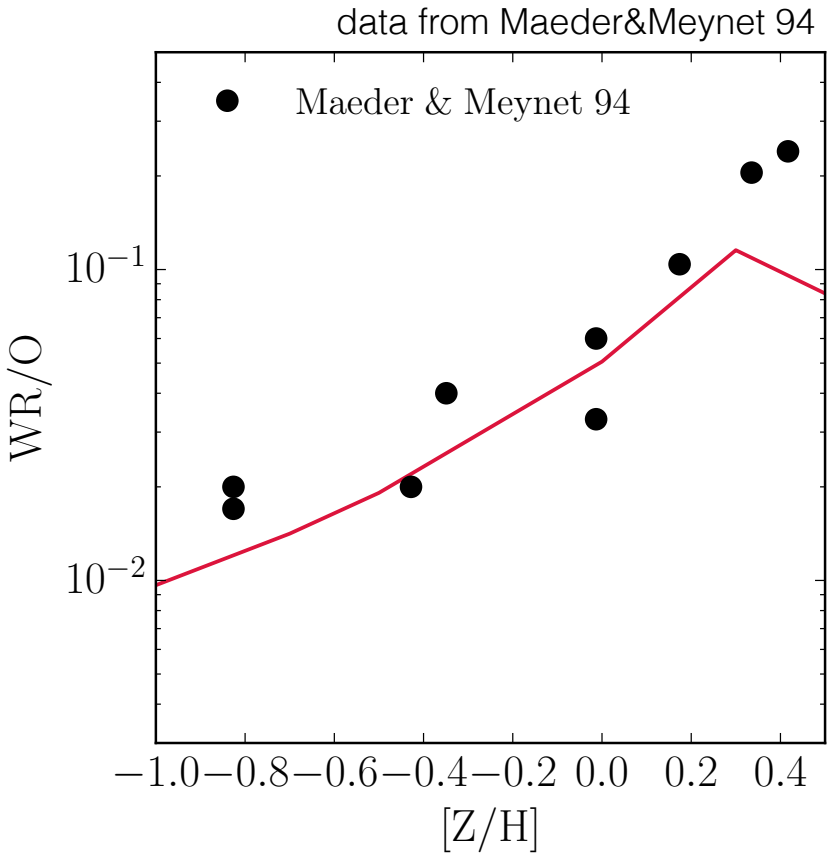

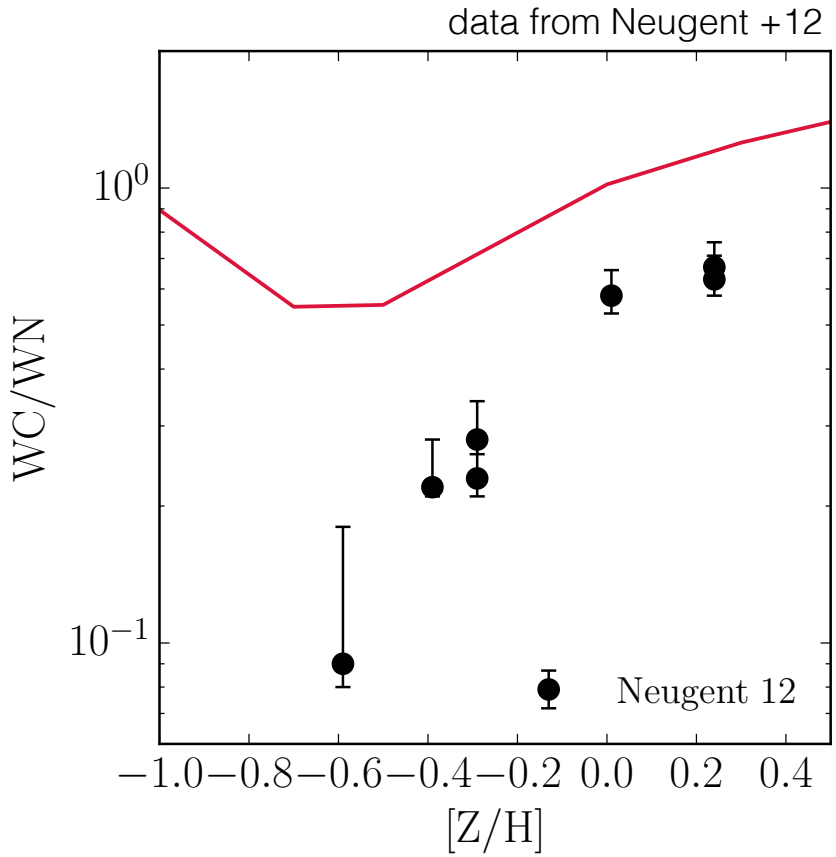

What's To Come?

1st release: solar-scaled (late spring/early summer this year)

2nd release: α-enhancement (+0.2 to +0.4 dex)

example applications

- incorporating a realistic velocity distribution into the models
- models with exact abundances when spec. info is available
- how well can we measure SFH, abundances, etc. from CMDs and stellar population synthesis models?

Discussion Questions

Large volumes of exquisite data and detailed analysis from asteroseismology—how do we digest the constraints from different parts of the HRD into a coherent theoretical framework?

What do you want in the evolutionary tracks and isochrones?