Modelling the binary F-type g-mode pulsator KIC 10080943

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fwo Opening new horizons

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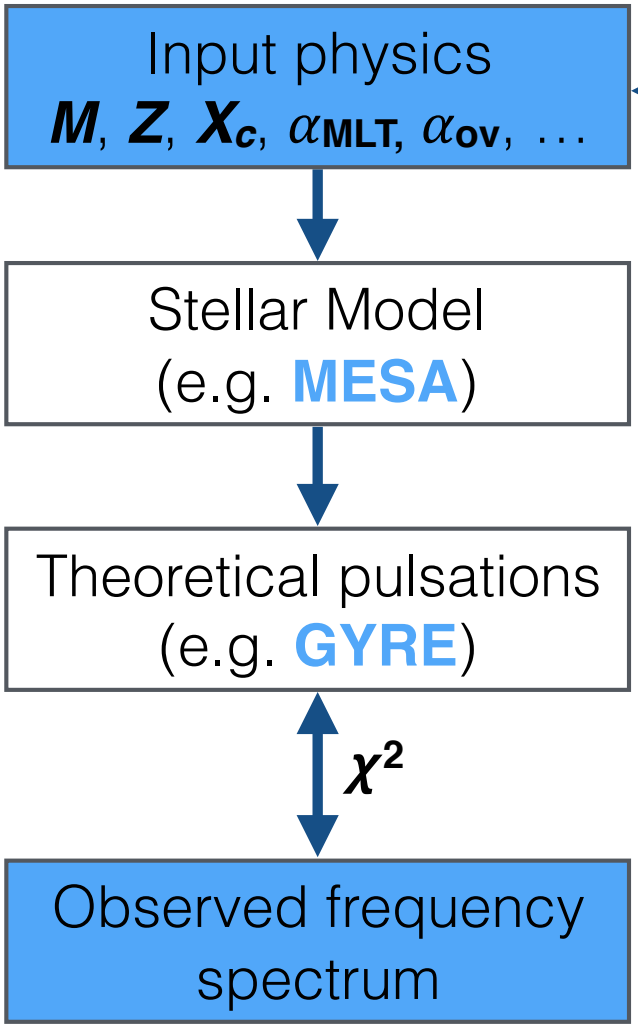
Synergy: seismology of binary stars



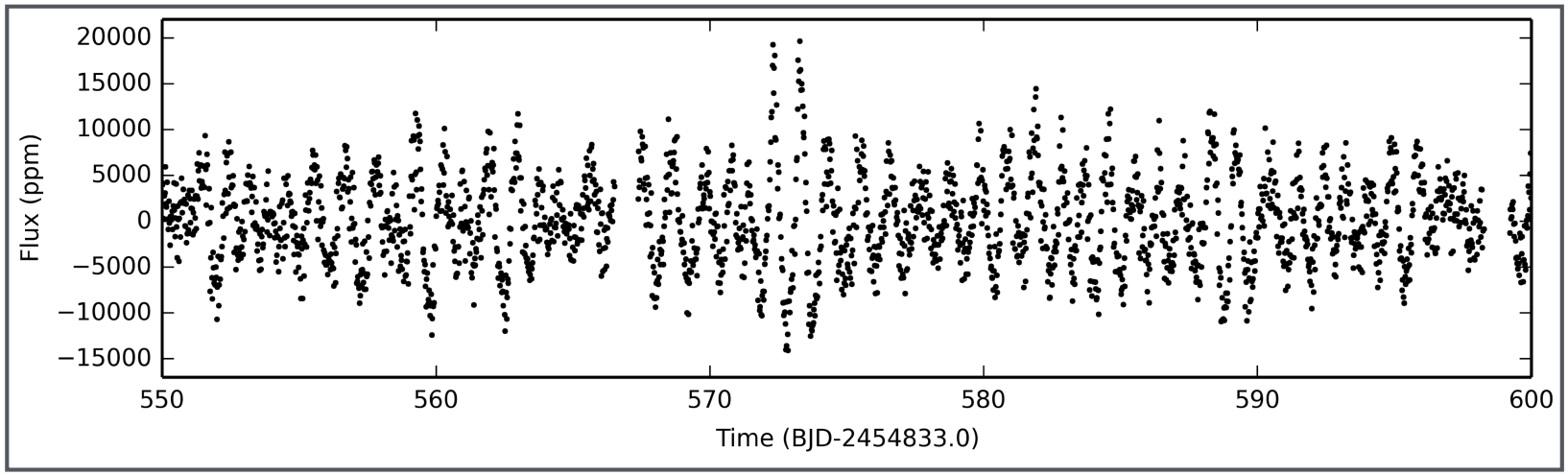
Double-lined eclipsing binaries: Stellar parameters

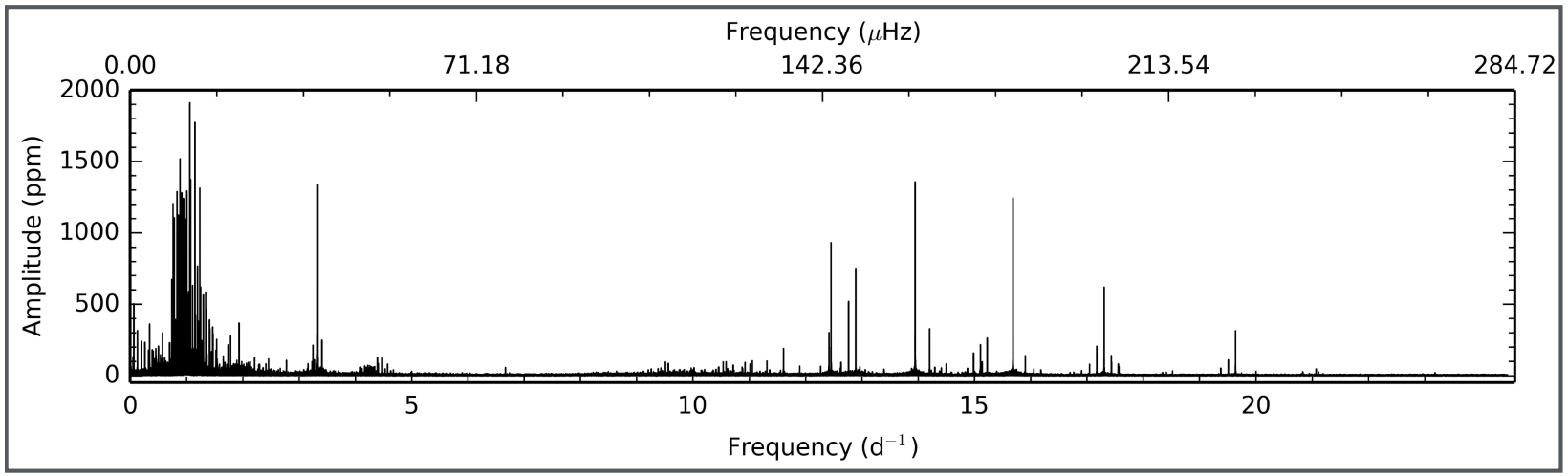
Equal age

Equal composition

Kepler data of KIC 10080943

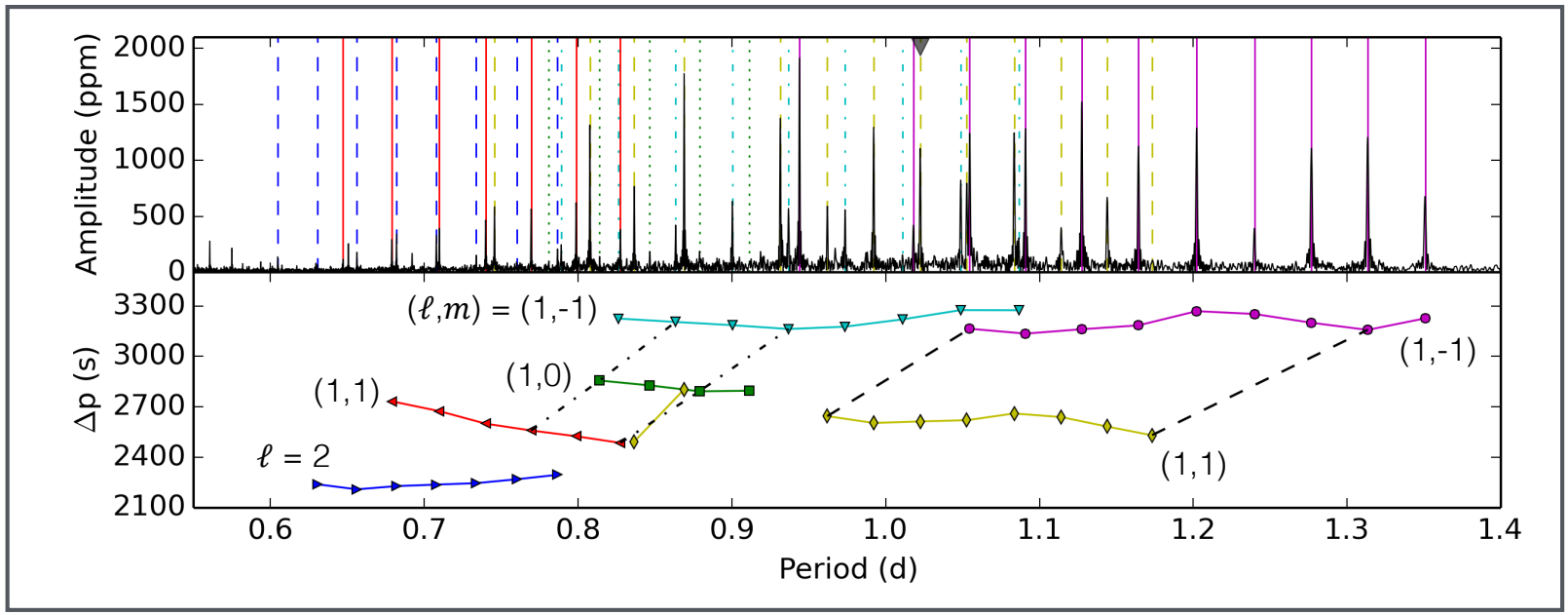
Schmid et al., A&A 584, A35 (2015)

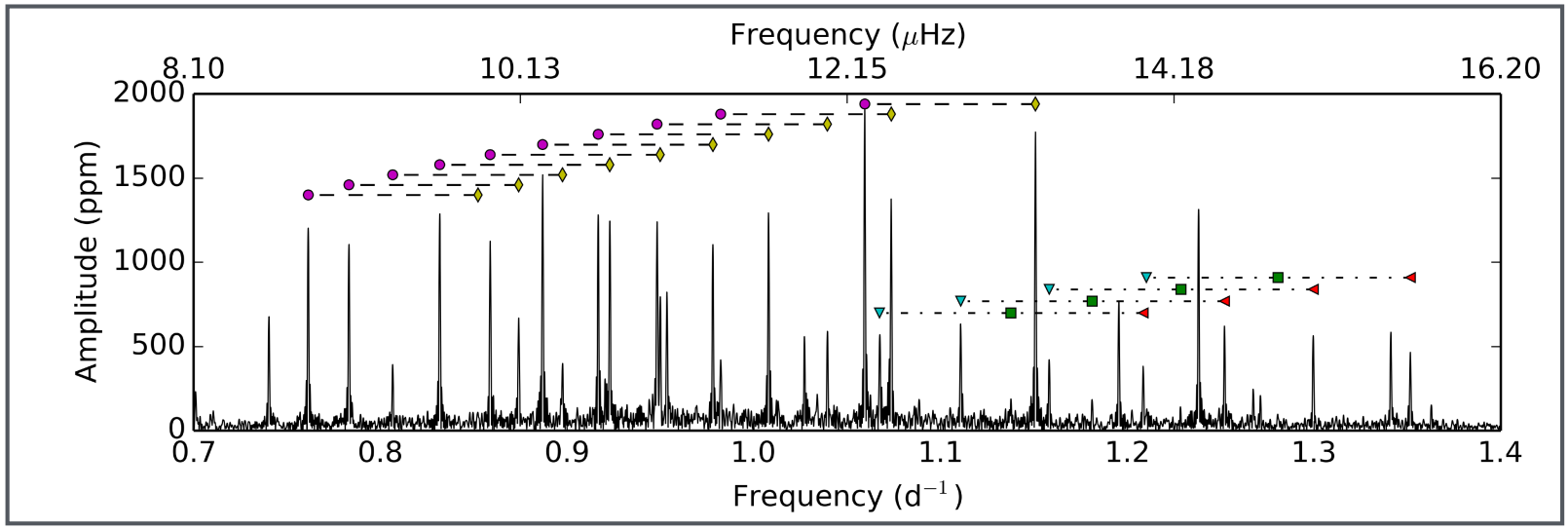




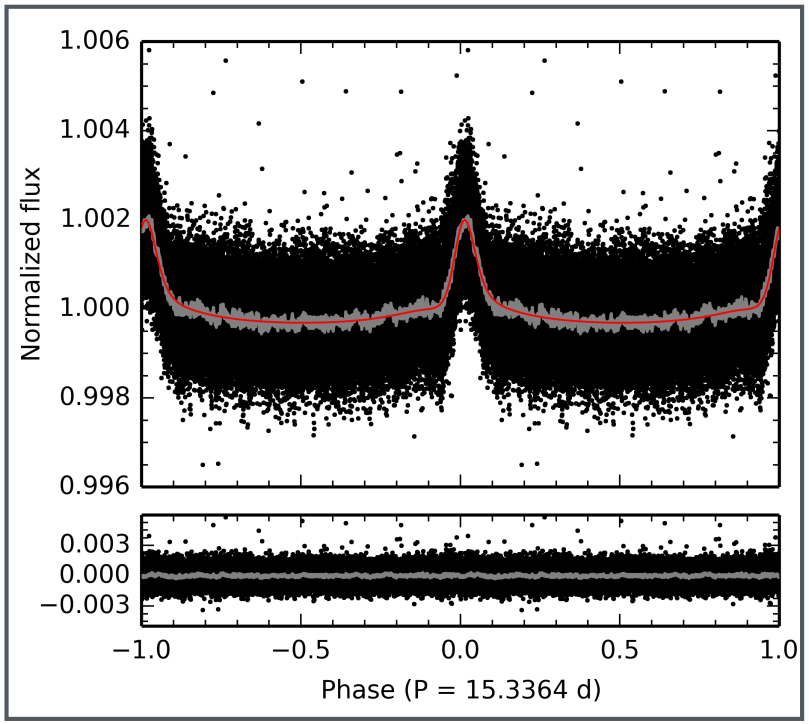
The gravity modes

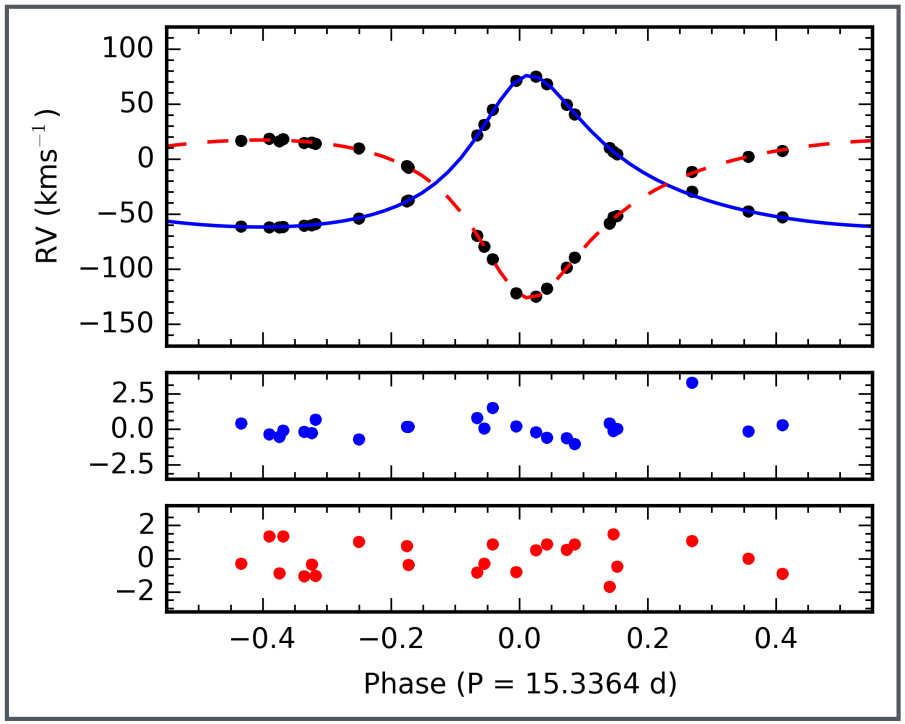
Period spacing and rotational splitting





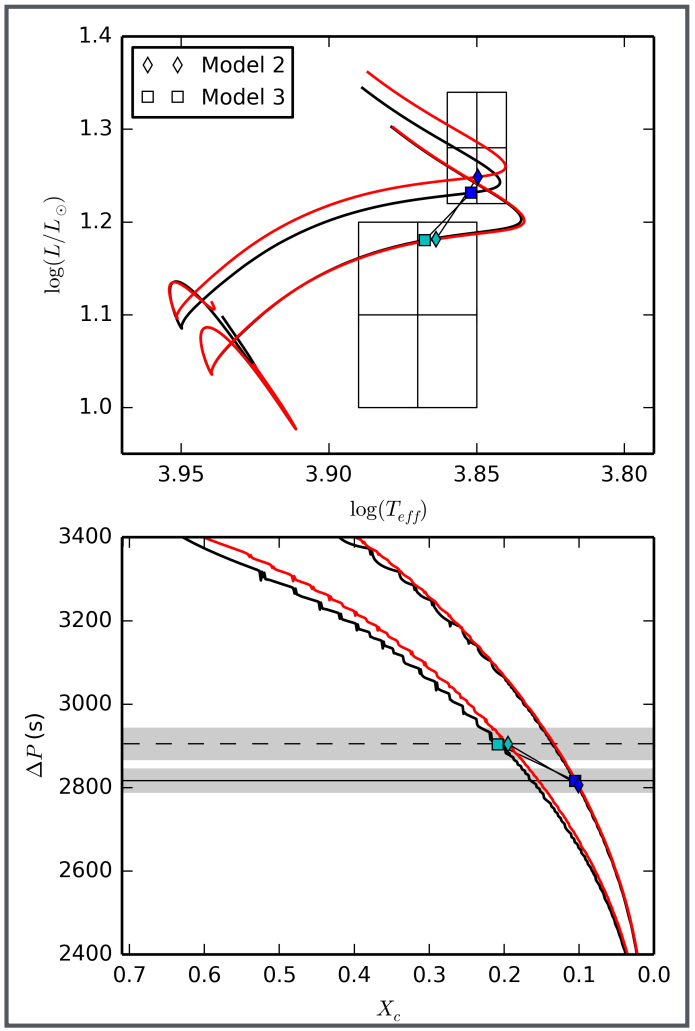
Binary modelling





a = 41.1 ±0.8 $R_\odot$	
M_1 = 2.0 ±0.1 $M_\odot$	M_2 = 1.9 ±0.1 $M_\odot$
R_1 = 2.9 ±0.1 $R_\odot$	R_2 = 2.1 ±0.2 $R_\odot$
log g_1 = 3.81 ±0.03	log g_2 = 4.1 ±0.1

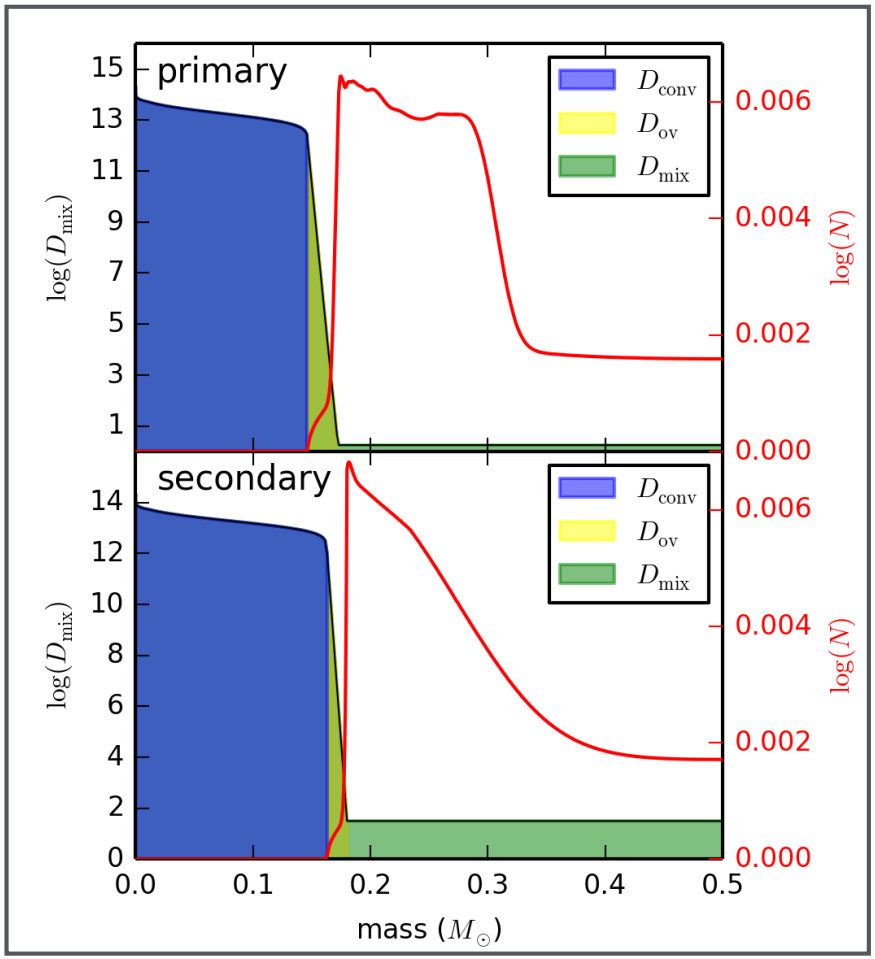
KIC 10080943 on the HRD



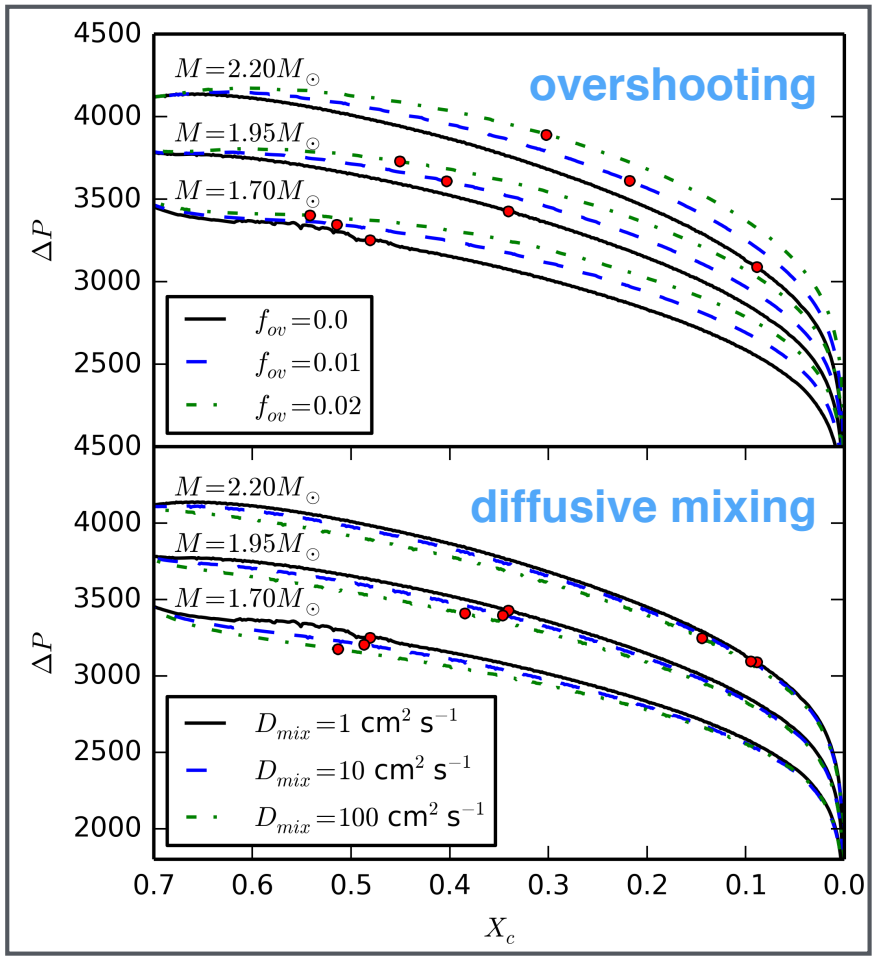
Best coeval models

Model 2	Model 3
$M_1 = 1.82\ M_\odot$	$M_1 = 1.81\ M_\odot$
$M_2 = 1.76\ M_\odot$	$M_2 = 1.76\ M_\odot$
$Z = 0.0125$	$Z = 0.0125$
$f_{ov,1} = 0.008\ H_p$	$\alpha_{ov,1} = 0.11\ H_p$
$f_{ov,2} = 0.005\ H_p$	$\alpha_{ov,2} = 0.05\ H_p$
$\log(D_{mix,1}) = 0.25$	$\log(D_{mix,1}) = 0.25$
$\log(D_{mix,2}) = 1.5$	$\log(D_{mix,2}) = 1.75$
$a_1 = 1.123$ Gyr	$a_1 = 1.110$ Gyr
$a_2 = 1.127$ Gyr	$a_2 = 1.110$ Gyr

MESA stellar models

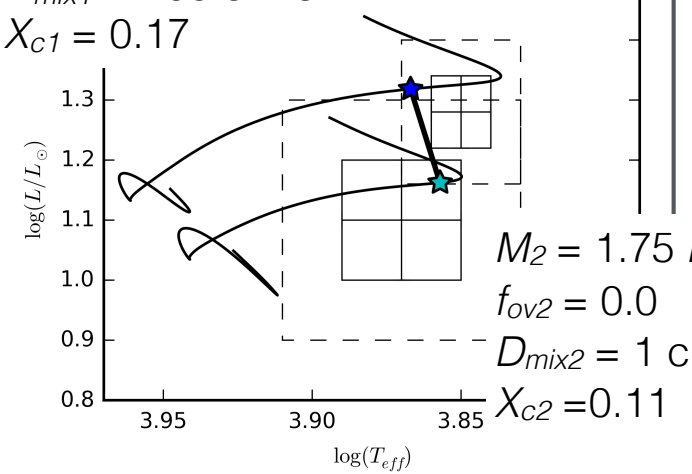


Interior structure of Model 2

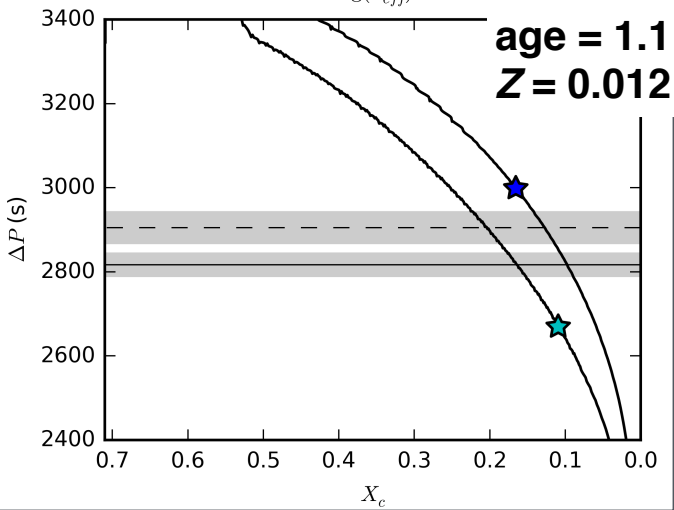


Influence of overshooting and diffusive mixing

M_1 = 1.85 $M_\odot$
f_{ov1} = 0.01
D_{mix1} = 100 cm^{2}s^{-1}
X_{c1} = 0.17

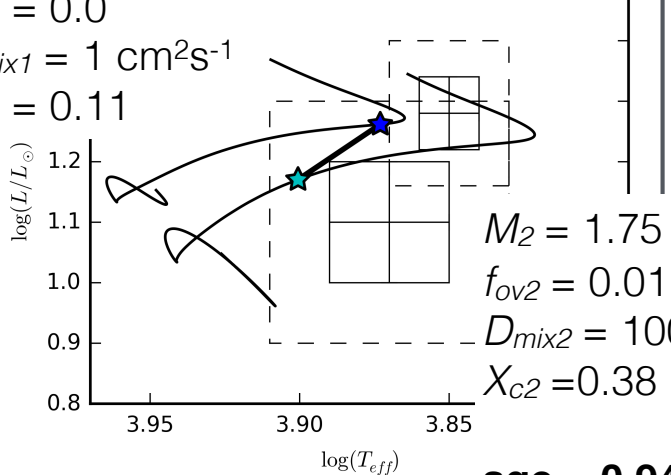


M_2 = 1.75 $M_\odot$
f_{ov2} = 0.0
D_{mix2} = 1 cm^{2}s^{-1}
X_{c2} =0.11

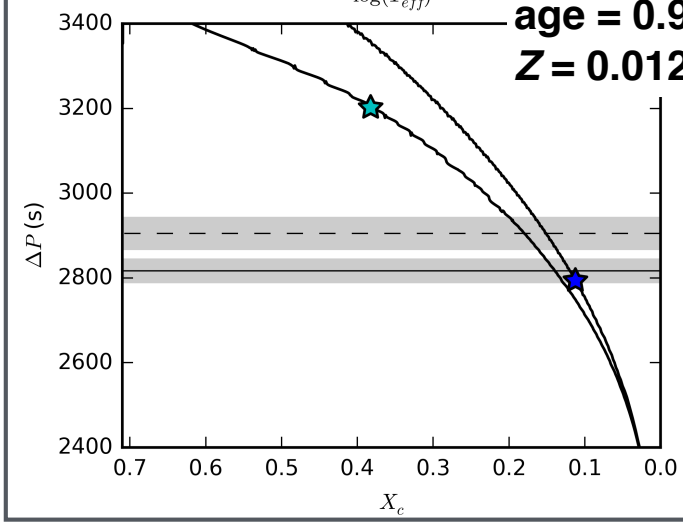


age = 1.1 Gyr
Z = 0.012

M_1 = 1.85 $M_\odot$
f_{ov1} = 0.0
D_{mix1} = 1 cm^{2}s^{-1}
X_{c1} = 0.11

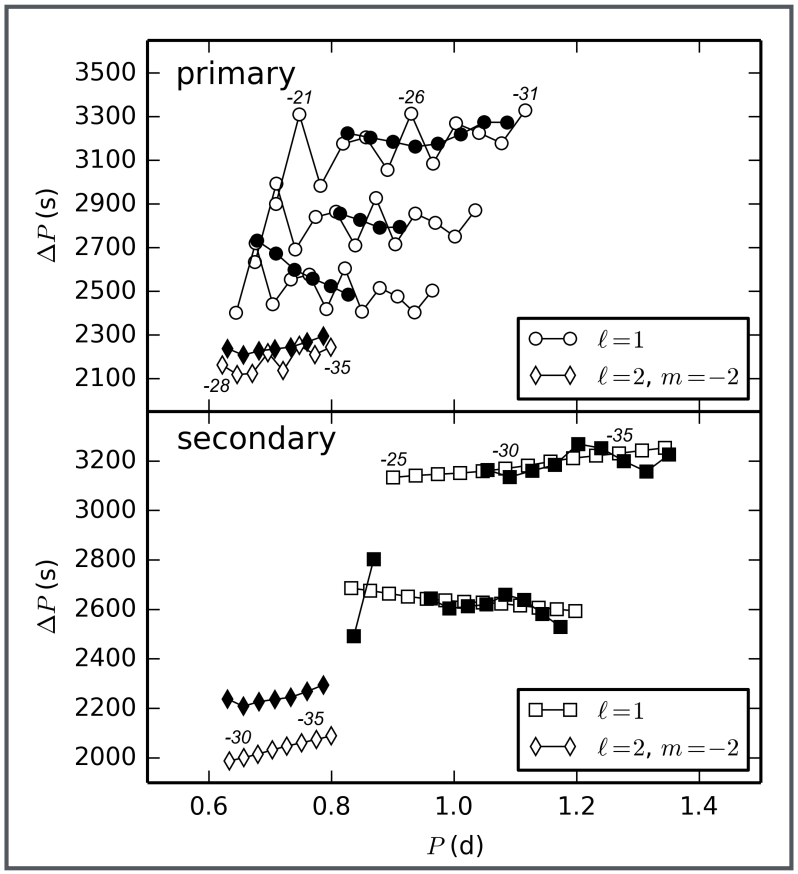


M_2 = 1.75 $M_\odot$
f_{ov2} = 0.01
D_{mix2} = 100 cm^{2}s^{-1}
X_{c2} =0.38



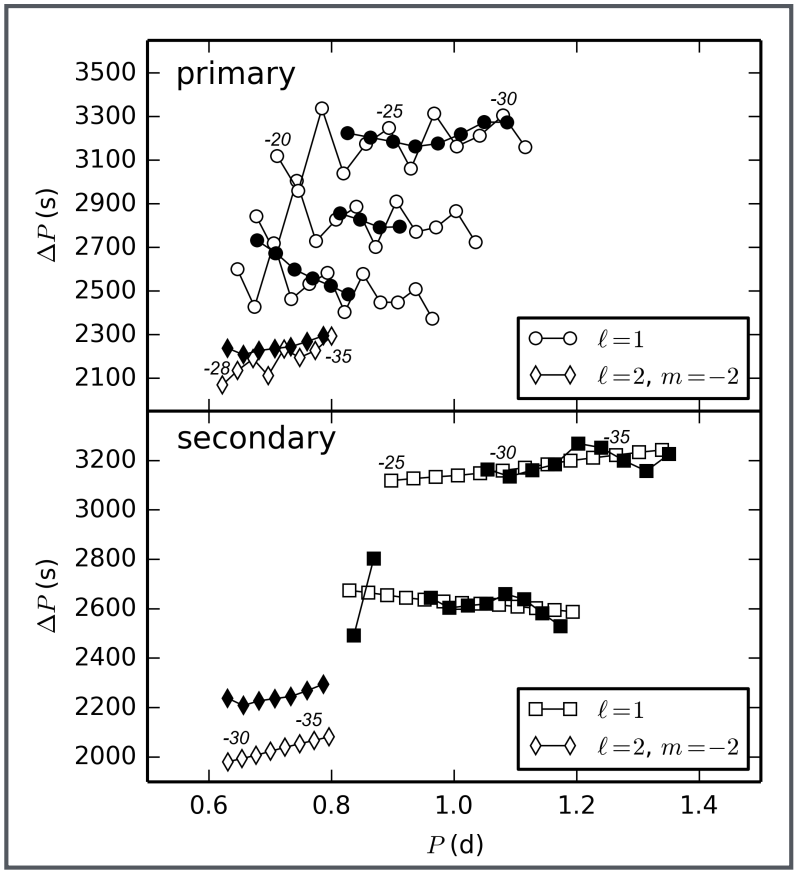
age = 0.94 Gyr
Z = 0.012

Period spacing morphology



Gravity modes of Model 2

exponential overshooting



Gravity modes of Model 3

step overshooting

Take-home message

- **Binarity** helps pin-point **chemical mixing**
- Observation of **level of chemical mixing** opportunity for testing theoretical predictions
- **Not** able to discriminate between **exponential and step overshooting** for this binary
- **More results**: Schmid & Aerts, A&A, in press (arXiv:1605.07958)

Period spacing morphology

M_1 = 1.67 $M_\odot$
f_{ov1} = 0.007
D_{mix1} = 3.16 cm^{2}s^{-1}
X_{c1} = 0.22