

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

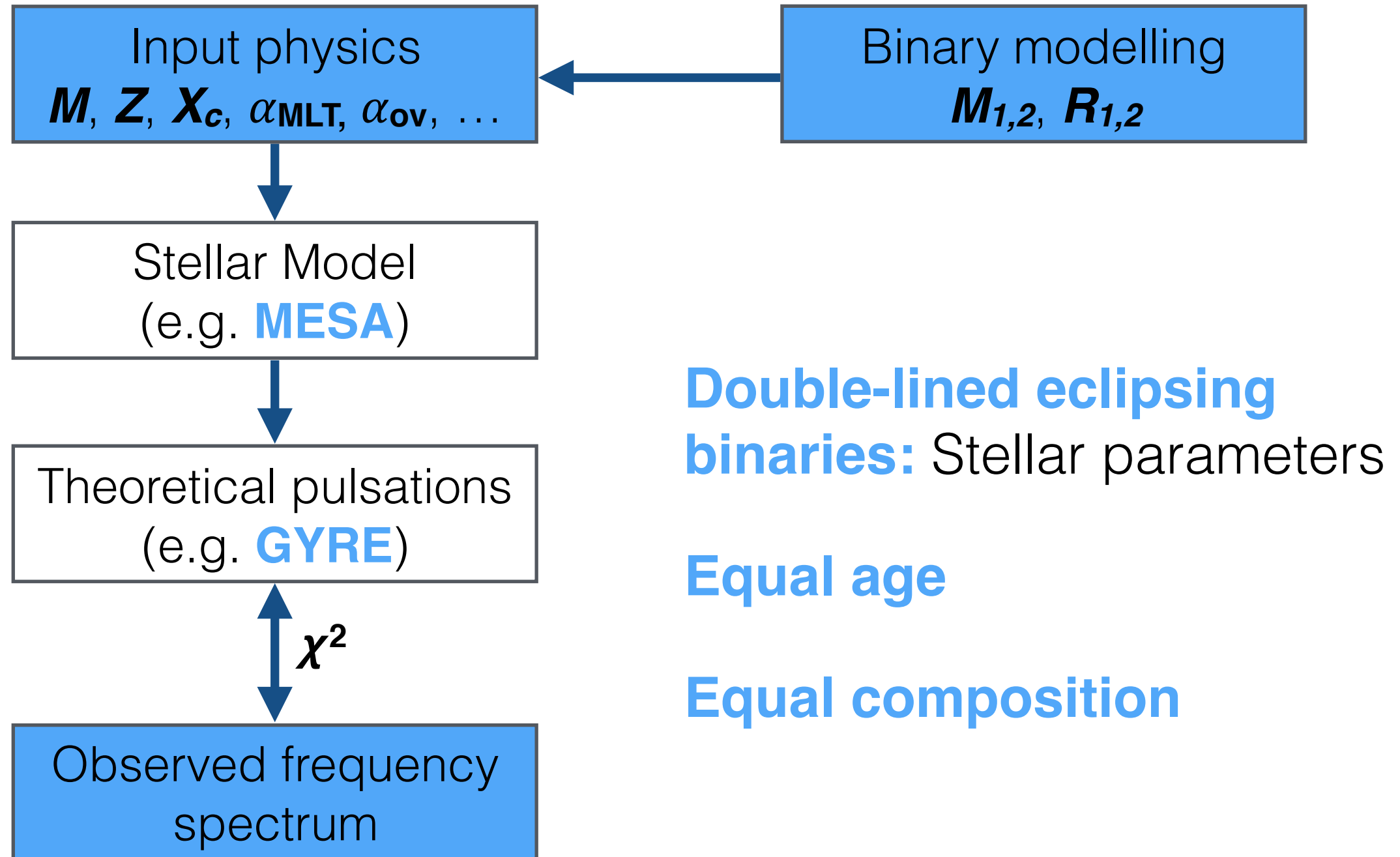
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15 September, 2016



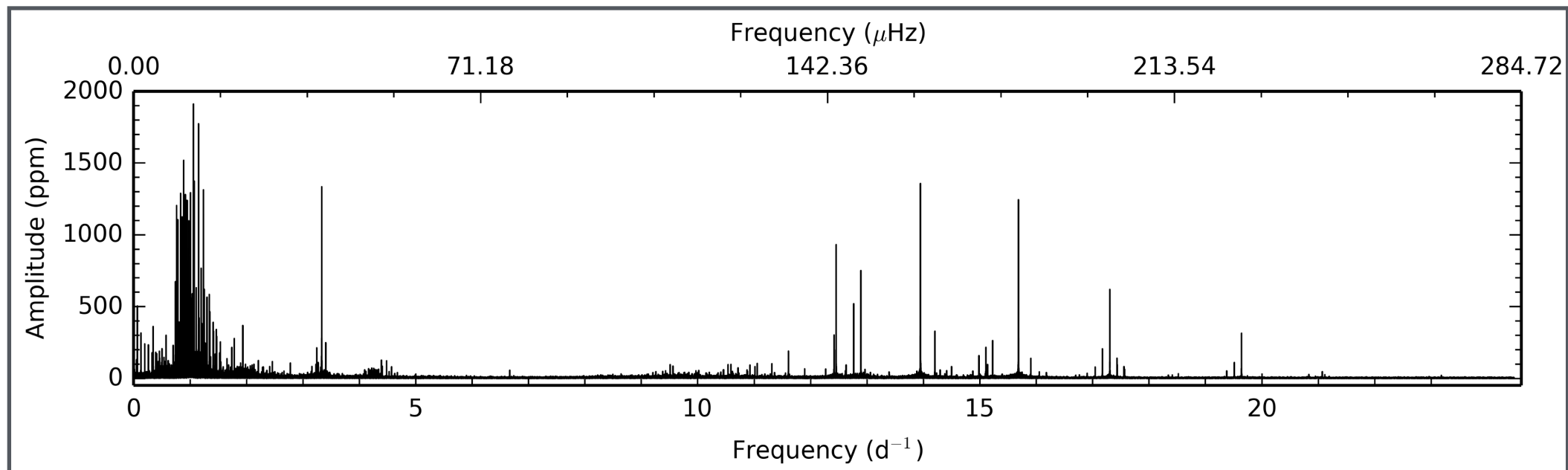
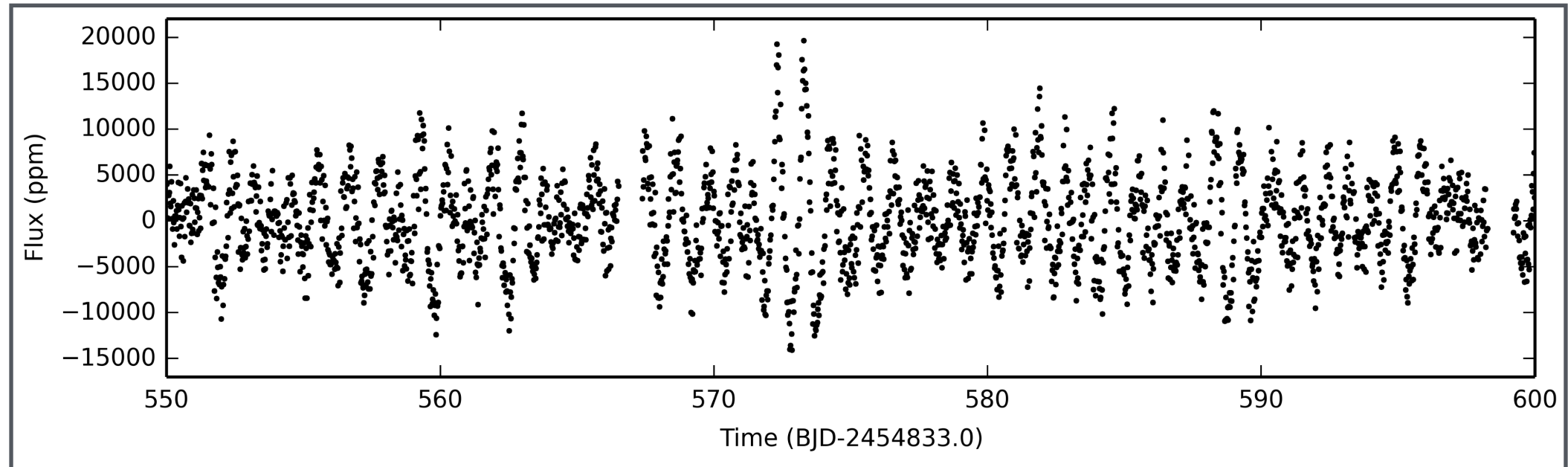
Opening new horizons

Synergy: seismology of binary stars



Example: KIC 10080943

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

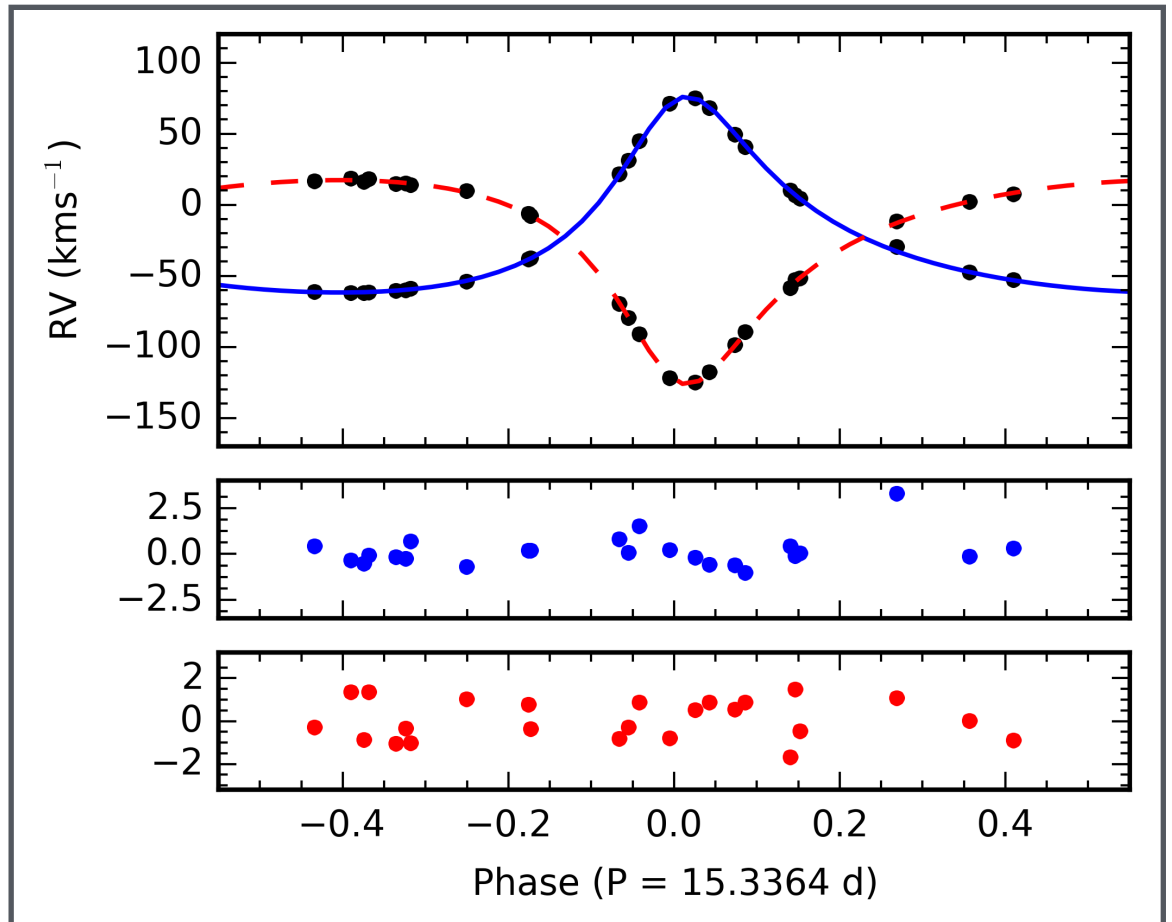
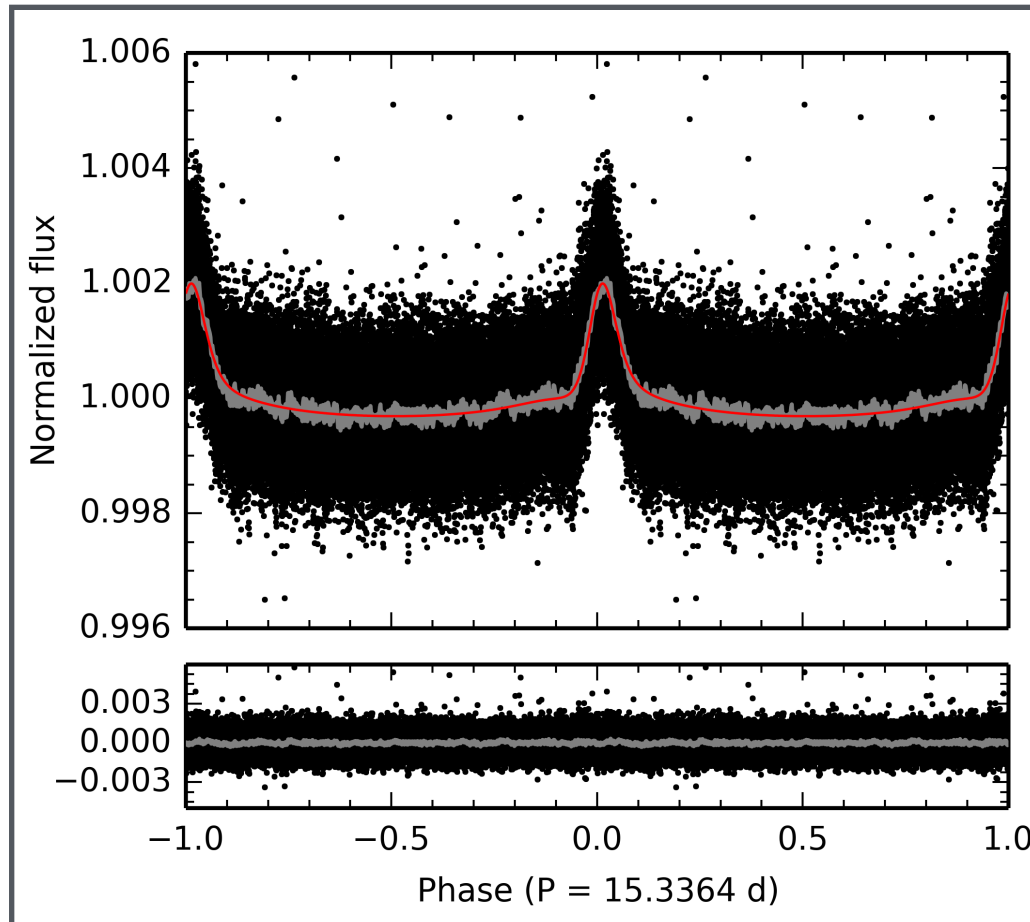


↔
 γ Dor g modes

↔
 δ Sct p modes

Binary modelling

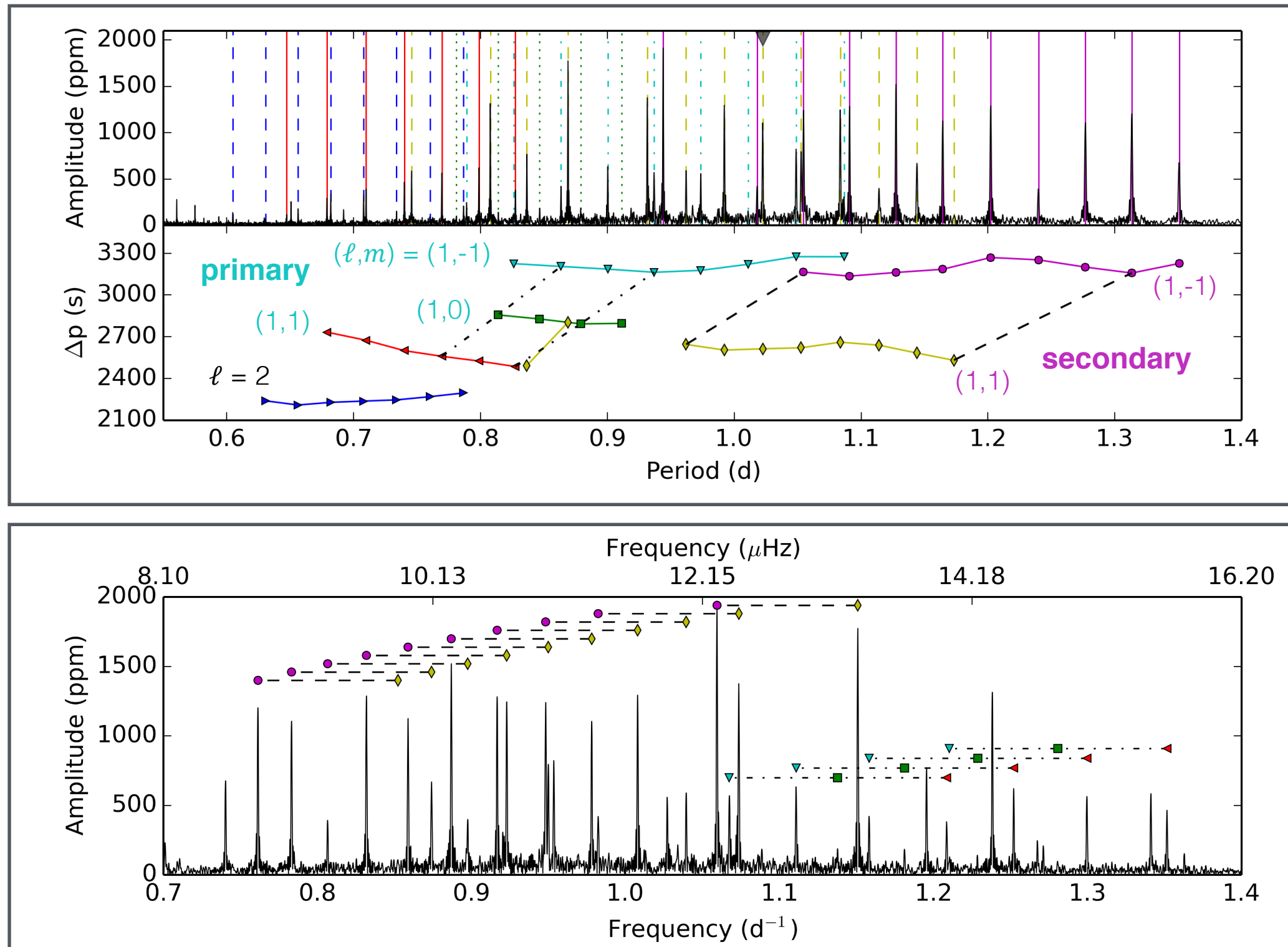
Schmid et al., A&A 584, A35 (2015)



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

The gravity modes

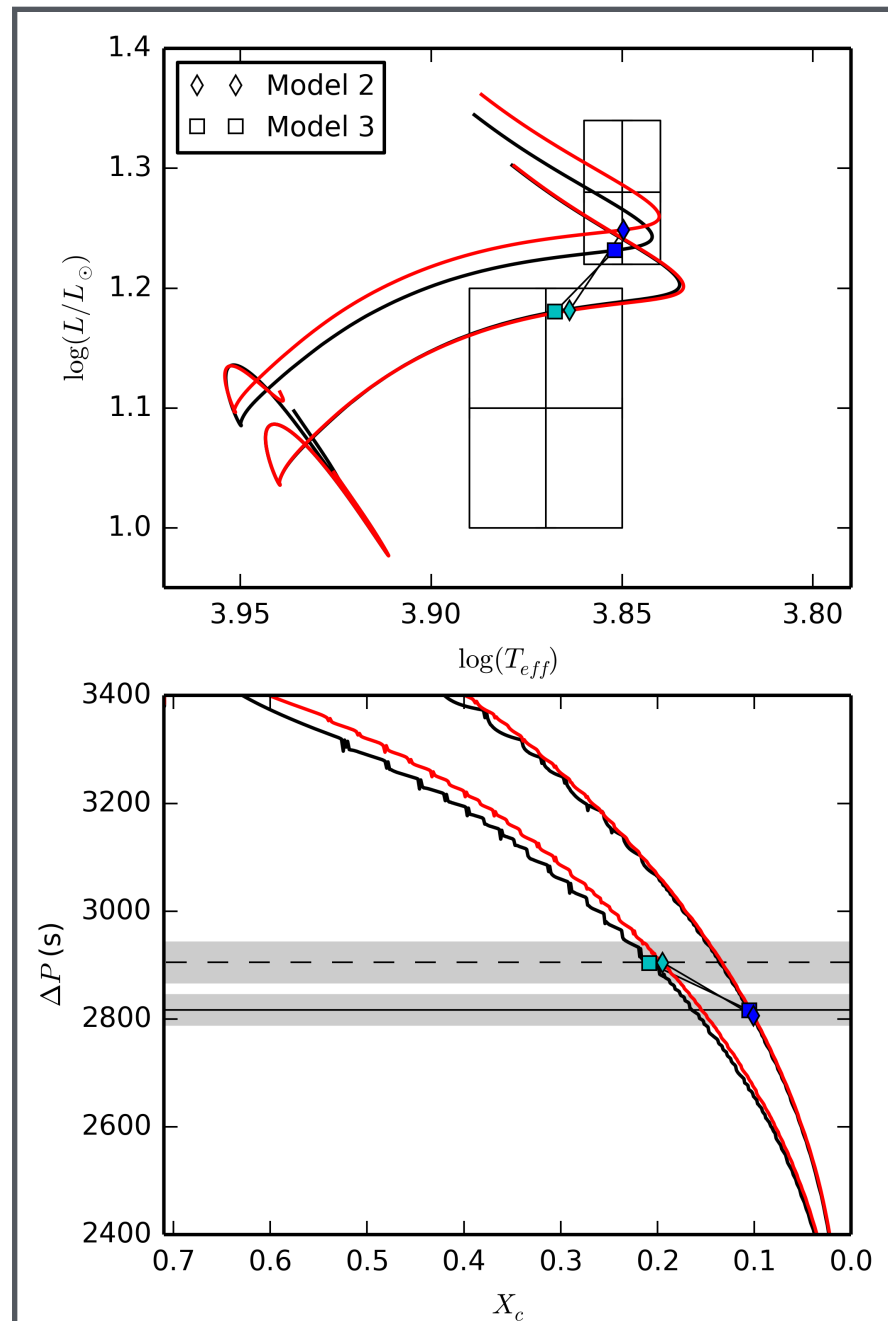
Period spacing and rotational splitting



Keen et al., MNRAS 454, 1792 (2015), Schmid et al., A&A 584, A35 (2015)

KIC 10080943 on the HRD

Schmid et al., A&A 592, A116 (2016)



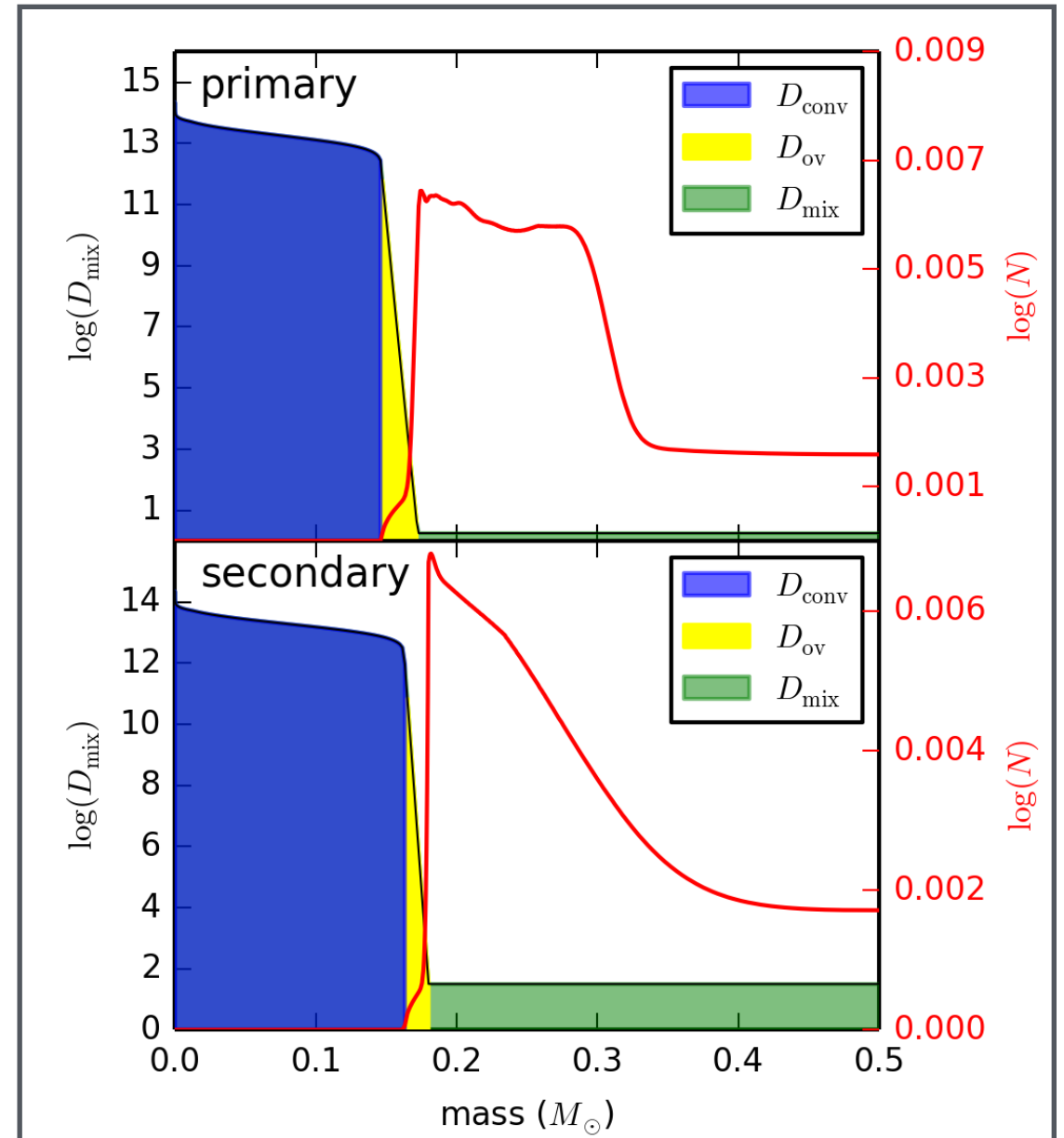
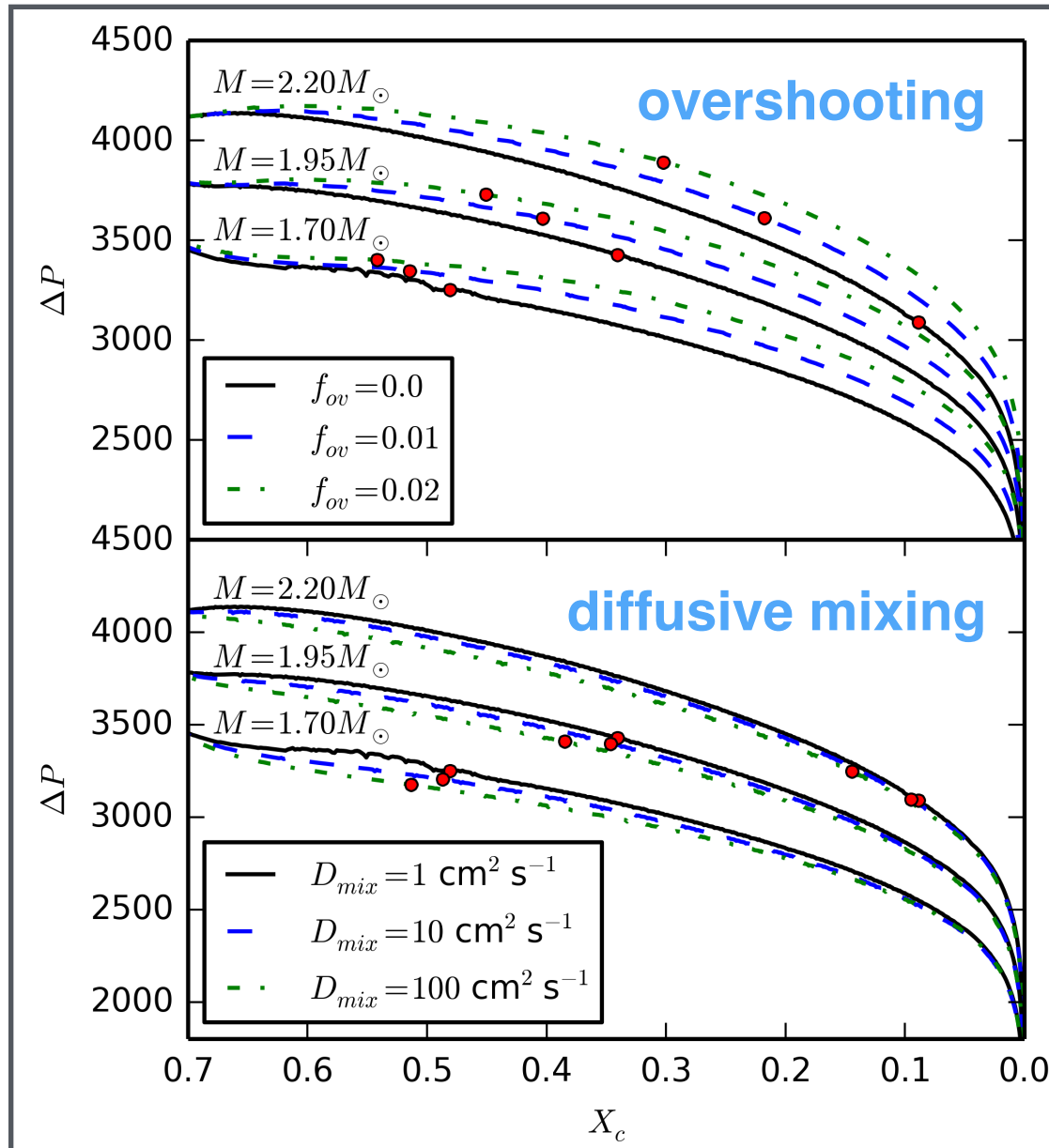
Best coeval models

The models of the stars need to have **equal age**, **equal composition**, and **mass ratio**

The models need to explain the **observed average period spacing**

MESA stellar models

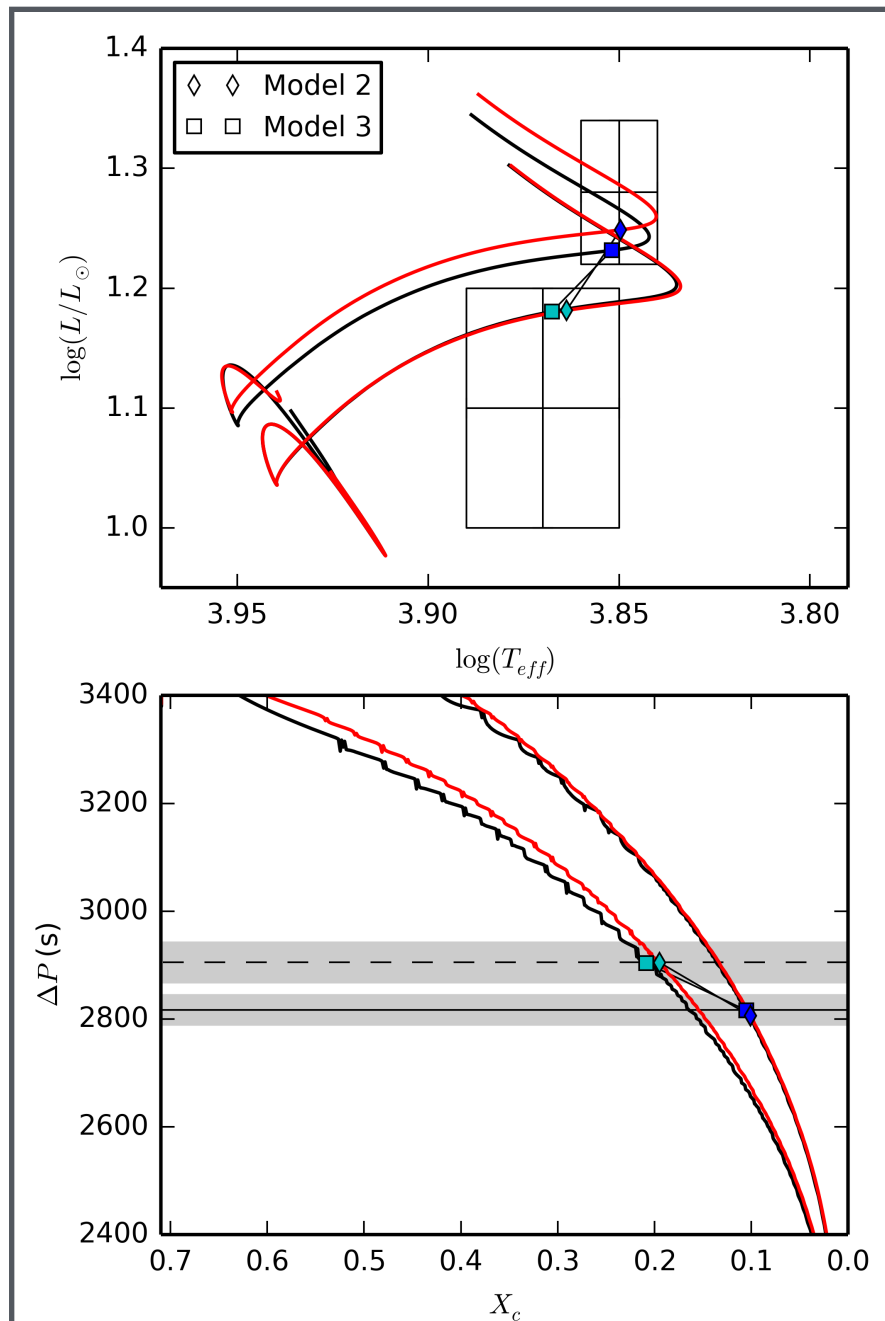
Schmid et al., A&A 592, A116 (2016)



Interior structure of best model
with exponential overshooting

KIC 10080943 on the HRD

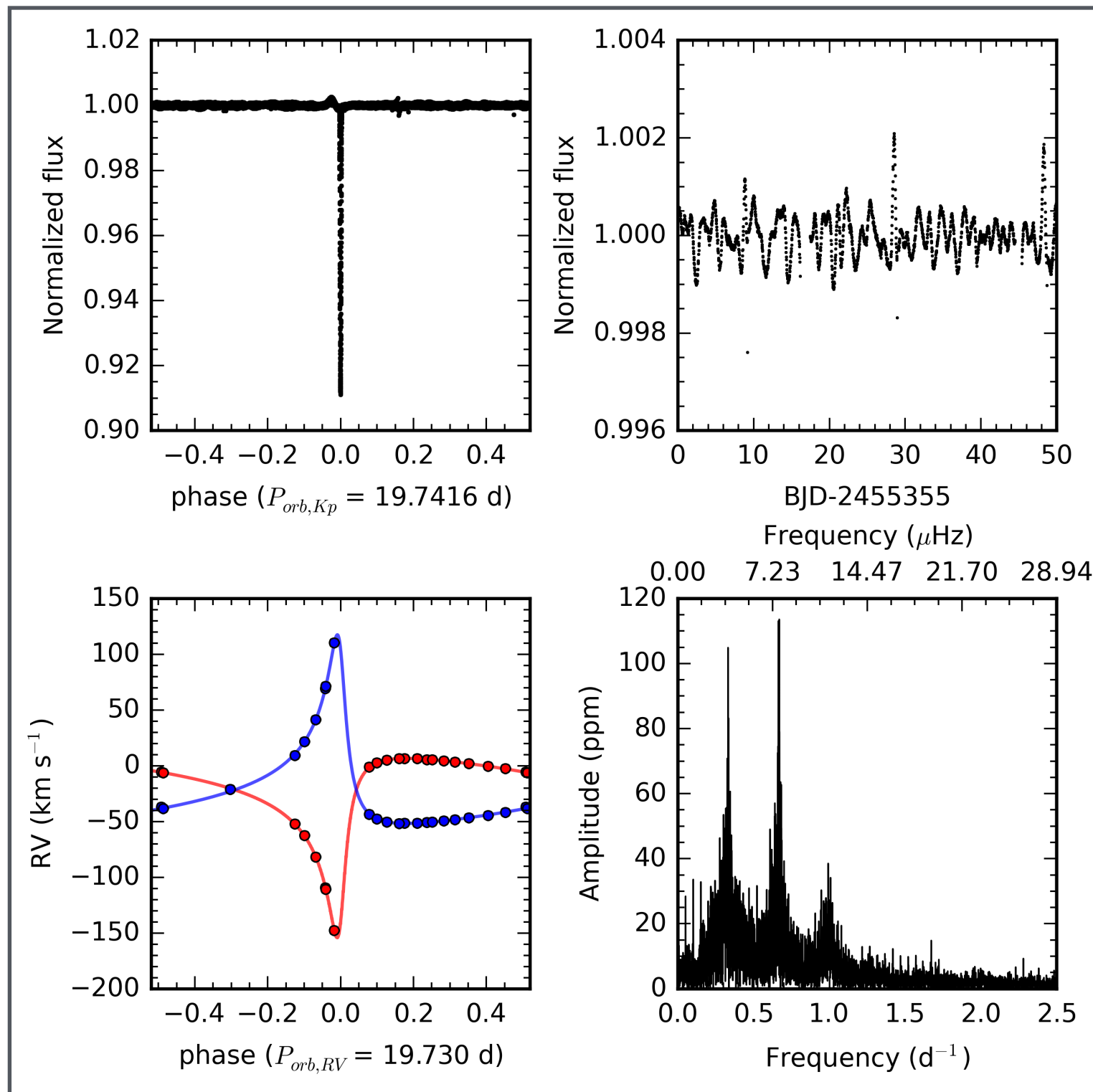
Schmid et al., A&A 592, A116 (2016)



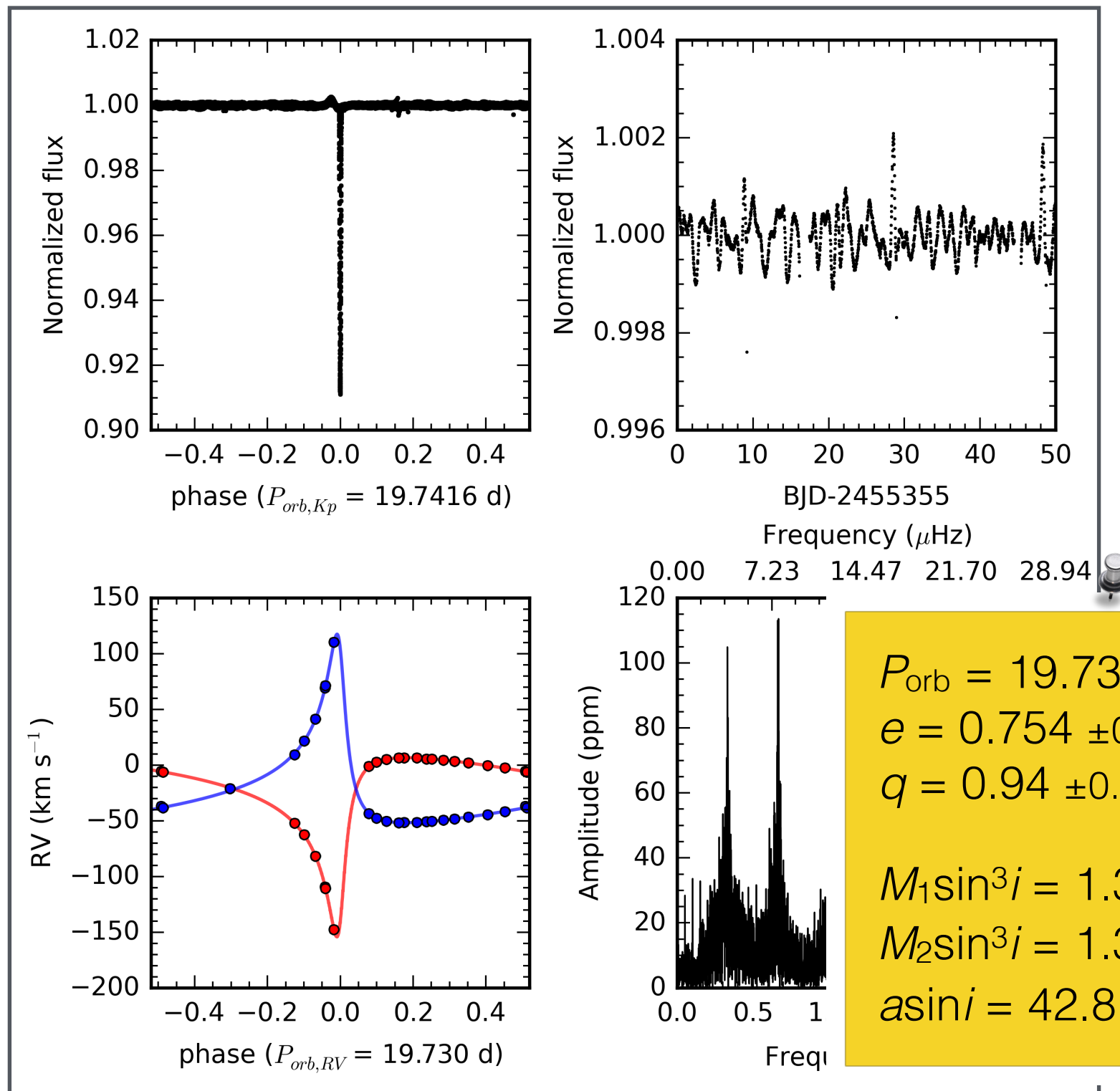
Best coeval models

Model 2 exponential ov.	Model 3 step overshooting
$M_1 = 1.82 M_{\odot}$	$M_1 = 1.81 M_{\odot}$
$M_2 = 1.76 M_{\odot}$	$M_2 = 1.76 M_{\odot}$
$Z = 0.0125$	$Z = 0.0125$
$a_1 = 1.123$ Gyr	$a_1 = 1.110$ Gyr
$a_2 = 1.127$ Gyr	$a_2 = 1.110$ Gyr

New binary pulsator: KIC6117415



New binary pulsator: KIC6117415



$$P_{orb} = 19.73 \pm 0.01 \text{ d}$$

$$e = 0.754 \pm 0.005$$

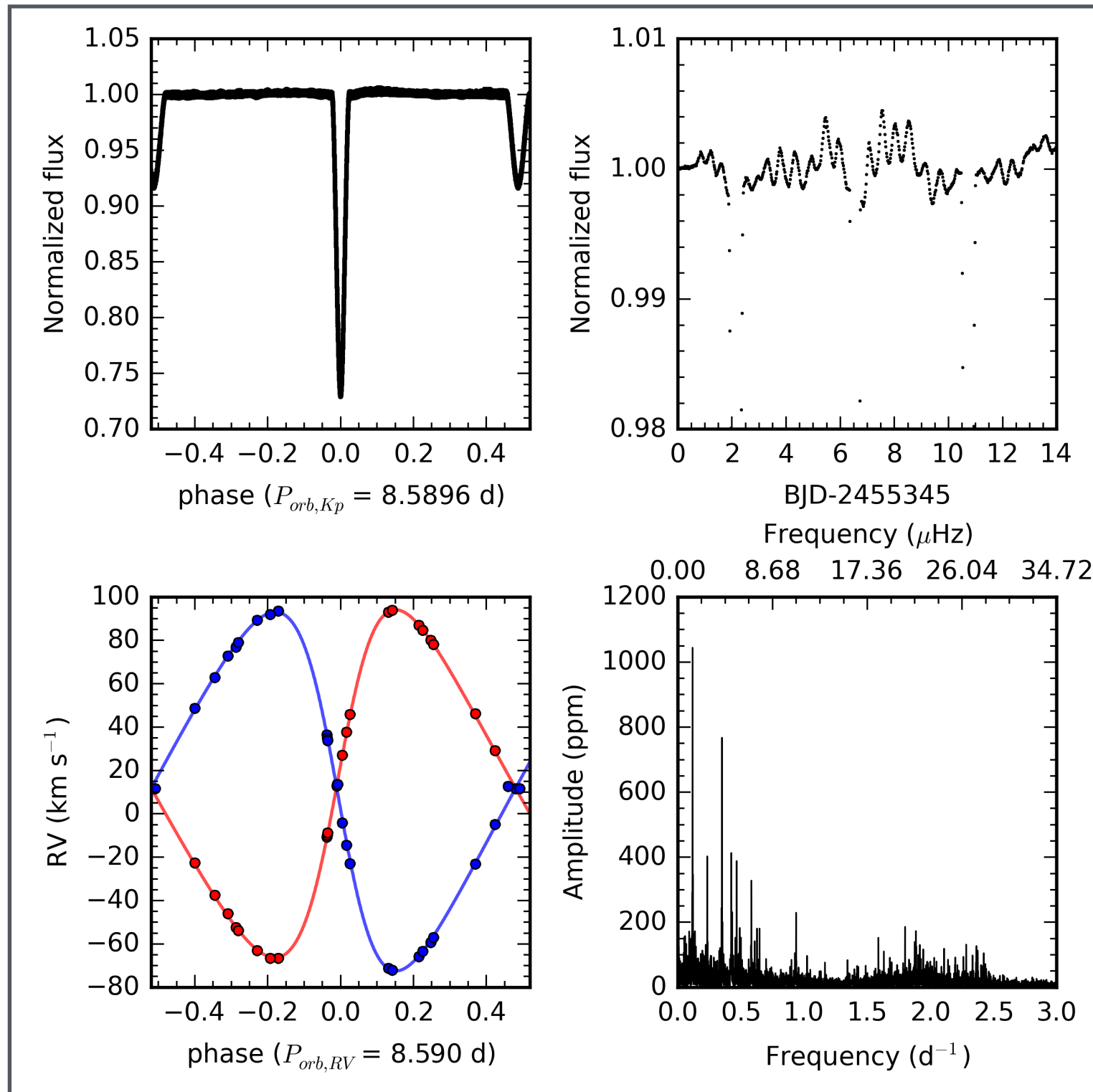
$$q = 0.94 \pm 0.02$$

$$M_1 \sin^3 i = 1.39 \pm 0.08 M_{\odot}$$

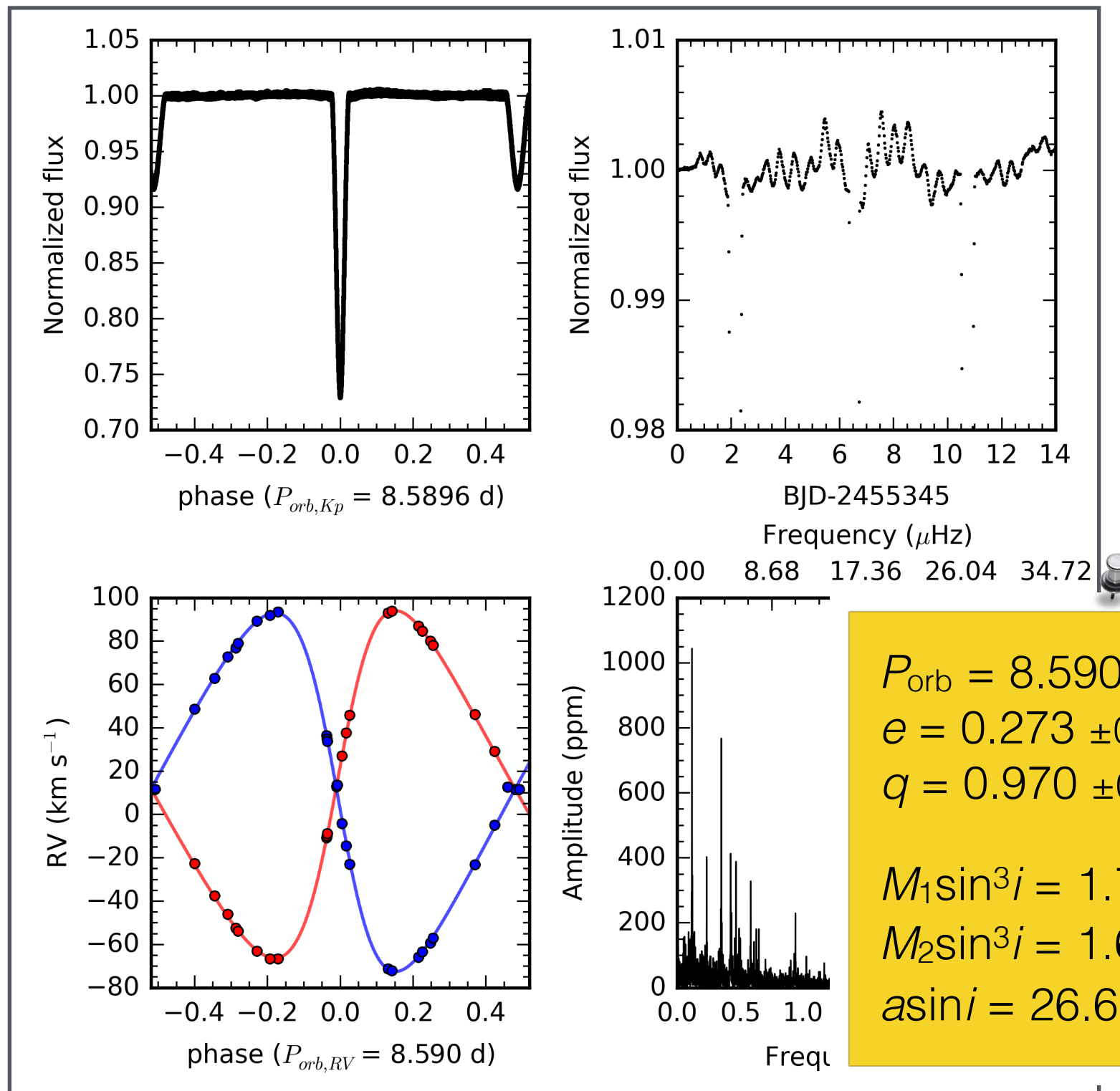
$$M_2 \sin^3 i = 1.31 \pm 0.06 M_{\odot}$$

$$a \sin i = 42.8 \pm 0.7 R_{\odot}$$

New binary pulsator: KIC10031808



New binary pulsator: KIC10031808



$$P_{\text{orb}} = 8.590 \pm 0.007 \text{ d}$$

$$e = 0.273 \pm 0.006$$

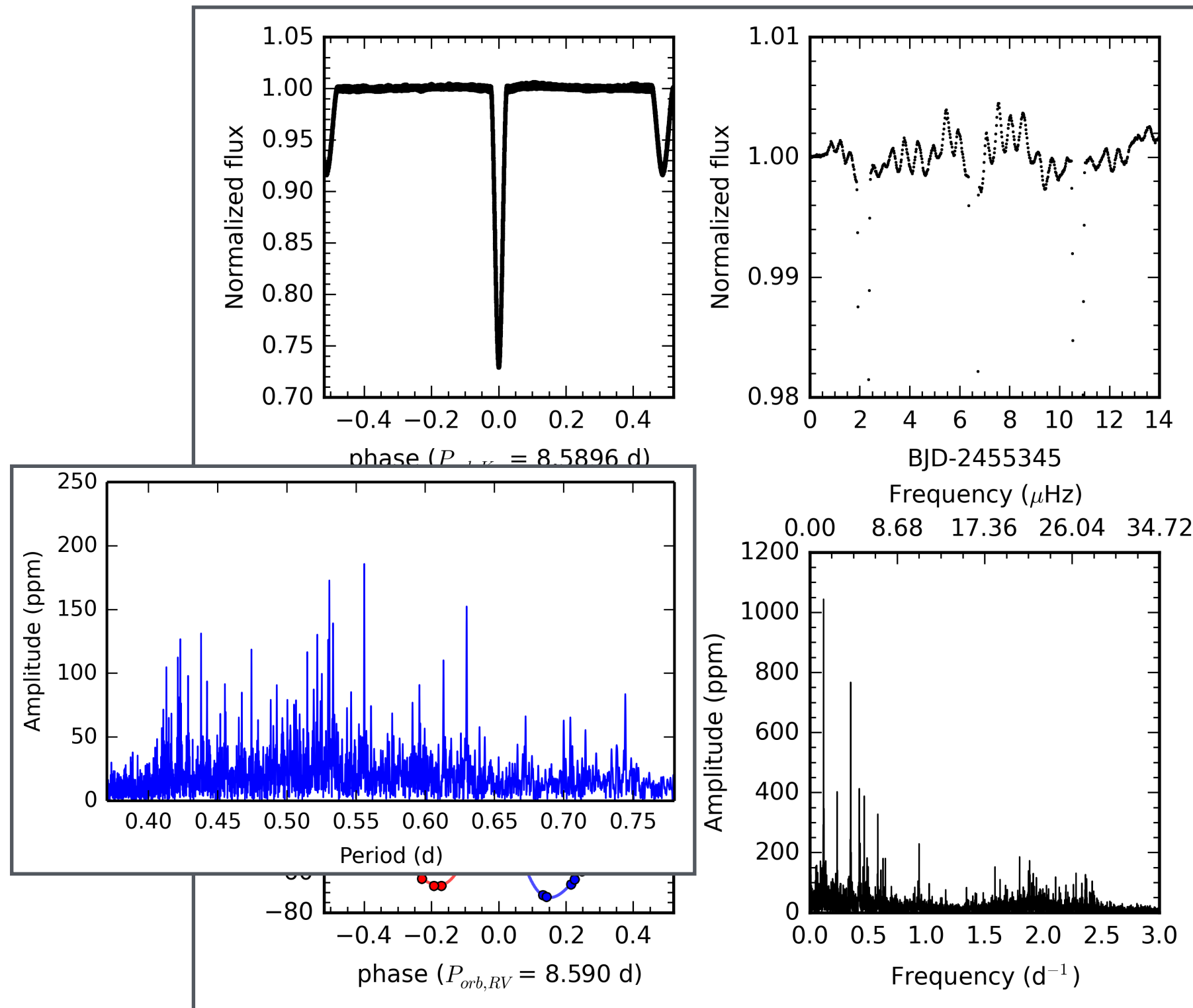
$$q = 0.970 \pm 0.009$$

$$M_1 \sin^3 i = 1.75 \pm 0.03 M_{\odot}$$

$$M_2 \sin^3 i = 1.69 \pm 0.03 M_{\odot}$$

$$a \sin i = 26.6 \pm 0.1 R_{\odot}$$

New binary pulsator: KIC10031808



Take-home message

- **Binarity** is an asset for seismic modelling: equal age, equal composition, and mass ratio
- **KIC 10080943:** Binarity helps constrain **level of chemical mixing**
- Eclipsing, double-lined binaries: **new examples**