

Theoretical Limits in Constraining Tidal Quality Factors of Binary Stars

JESSICA BIRKY AND RORY BARNES

ABSTRACT

1. INTRODUCTION

2. METHODS

2.1. *Observational Constraints*

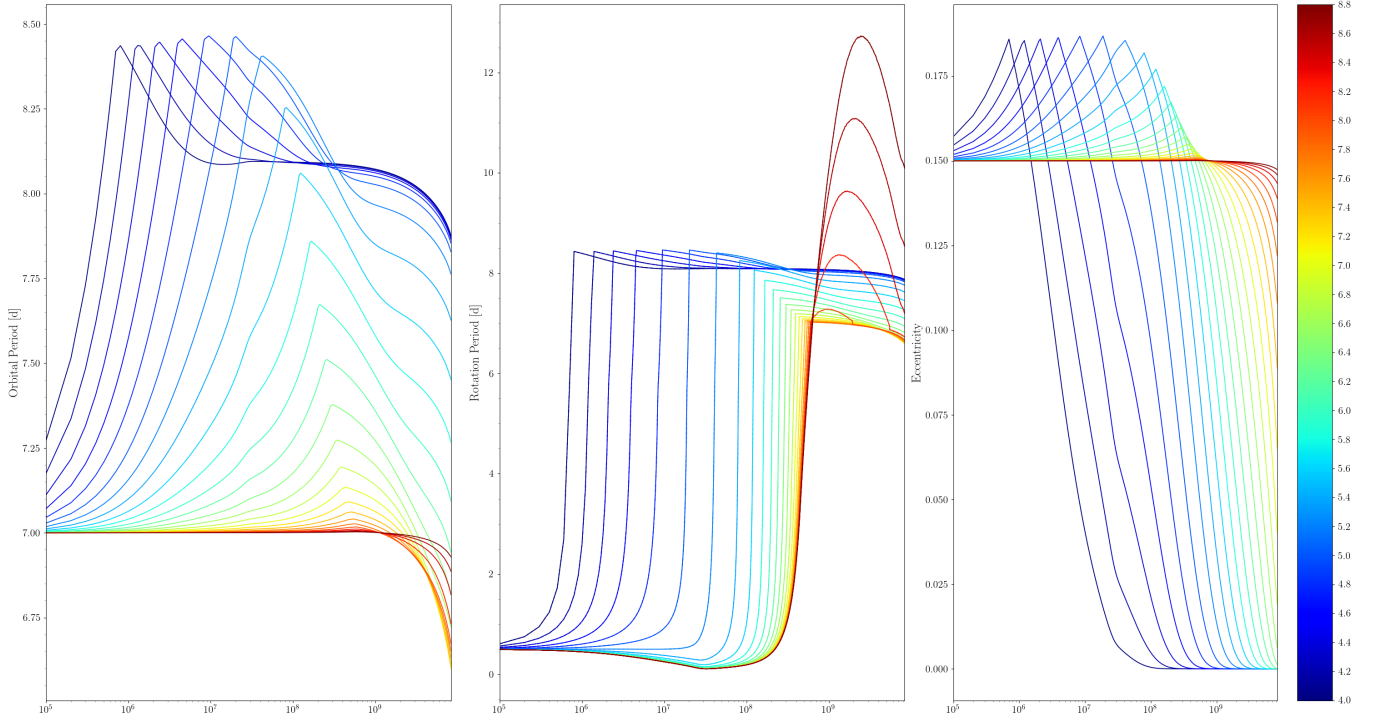
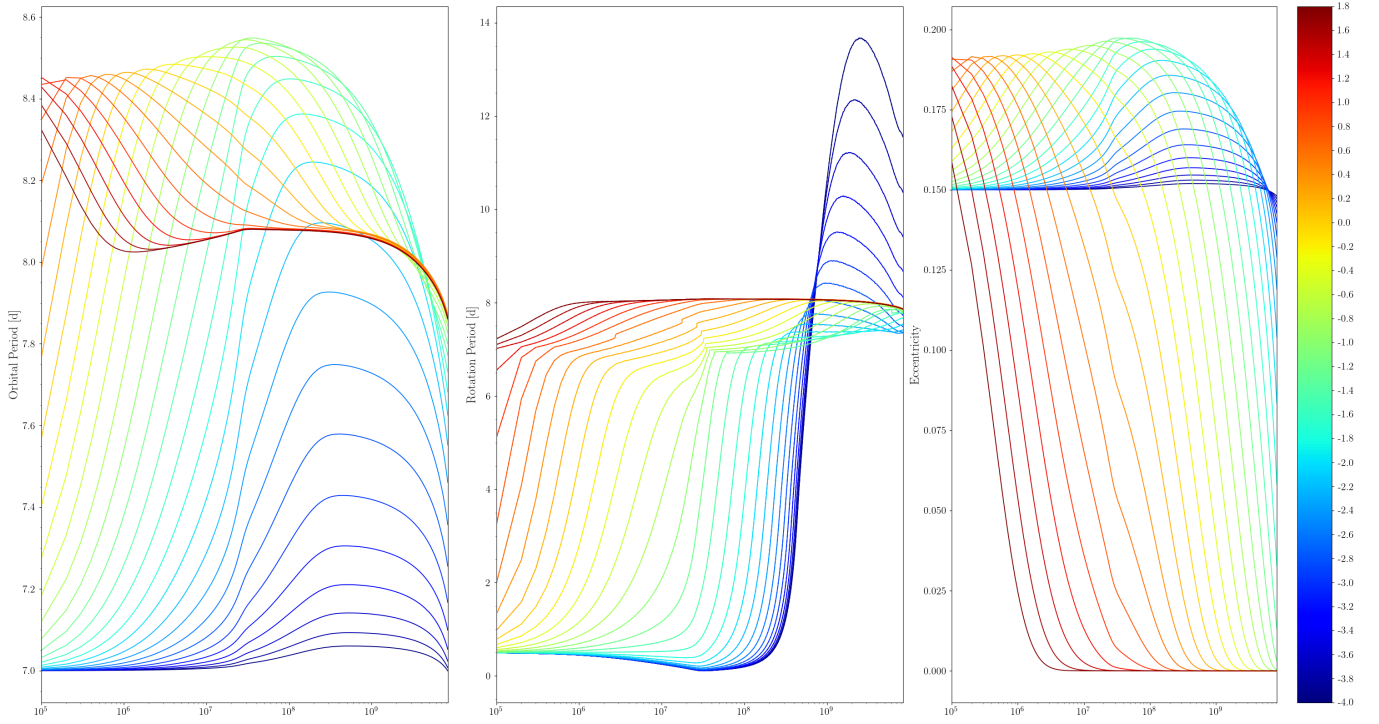
Model input parameters and prior constraints:

	Model Input	Prior	Observational Constraint	Good Unc
M_1	primary mass [M_\odot]	$\mathcal{N}(m, s)$	kepler solution (lc eclipse + rvs)	0.001
M_2	secondary mass [M_\odot]	$\mathcal{N}(m, s)$	kepler solution (lc eclipse + rvs)	0.001
$P_{\text{rot}1,i}$	pri init rotation period [days]	$\log\mathcal{N}(m, s)$	dist in young open clusters	
$P_{\text{rot}2,i}$	sec init rotation period [days]	$\log\mathcal{N}(m, s)$	dist in young open clusters	
$P_{\text{orb},i}$	init orbital period [days]	$\mathcal{U}(4.0, 10.0)$	uninformed	
e_i	init eccentricity	$\mathcal{U}(0, 0.5)$	uninformed	
age	system age [yr]	$\mathcal{N}(m, s)$	open cluster age	10%
$\varepsilon_{1,i}$	pri init obliquity [deg]	$\mathcal{U}(0, 30)$	uninformed	
$\varepsilon_{2,i}$	sec init obliquity [deg]	$\mathcal{U}(0, 30)$	uninformed	
\mathcal{Q}_1	pri tidal phase lag	$\mathcal{U}(4, 9)$	uninformed	
\mathcal{Q}_2	sec tidal phase lag	$\mathcal{U}(4, 9)$	uninformed	
τ_1	pri tidal time lag [log(s)]	$\mathcal{U}(-4, 2)$	uninformed	
τ_2	sec tidal time lag [log(s)]	$\mathcal{U}(-4, 2)$	uninformed	

Model output parameters and likelihood constraints:

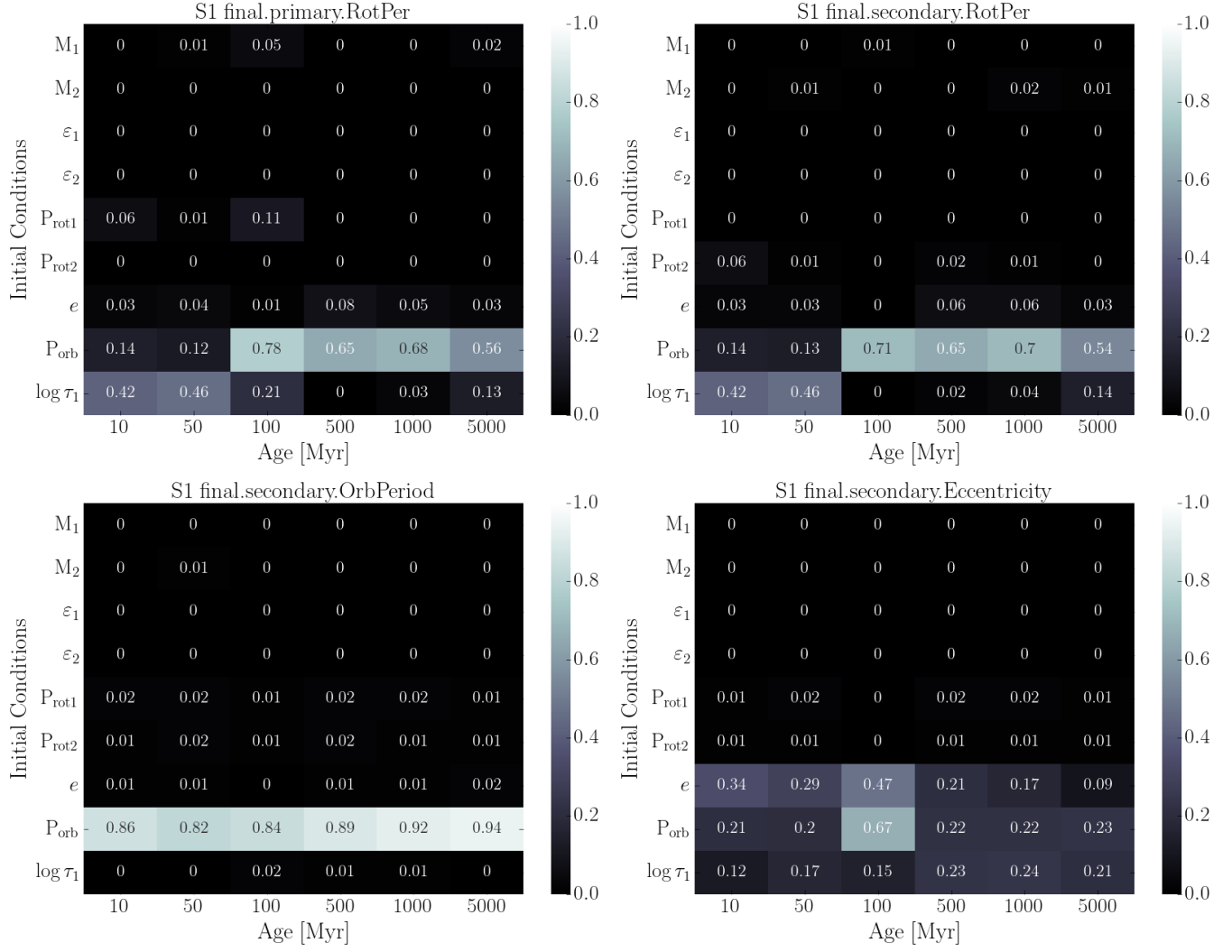
	Model Output	Likelihood	Observational Constraint	Good Unc
$P_{\text{rot}1,f}$	pri final rotation period [days]	$\mathcal{N}(m, s)$	lc autocorrelation function	0.1
$P_{\text{rot}2,f}$	sec final rotation period [days]	$\mathcal{N}(m, s)$	spectroscopic $v \sin i$	0.1
$P_{\text{orb},f}$	final orbital period [days]	$\mathcal{N}(m, s)$	lc lomb scargle	10^{-5}
e_f	final eccentricity	$\mathcal{N}(m, s)$	lc eclipse + rvs	0.001
$R_{1,f}$	pri final radius [R_\odot]	$\mathcal{N}(m, s)$	stellar models + photometry	0.01
$R_{2,f}$	sec final radius [R_\odot]	$\mathcal{N}(m, s)$	eclipse shape + pri radius	0.01
$L_{1,f}$	pri final luminosity [L_\odot]	$\mathcal{N}(m, s)$	stellar models + photometry	0.1
$L_{2,f}$	sec final luminosity [L_\odot]	$\mathcal{N}(m, s)$	stellar models + photometry	0.1
$T_{\text{eff}1,f}$	pri final temperature [K]	$\mathcal{N}(m, s)$	stellar models + spectra	
$T_{\text{eff}2,f}$	sec final temperature [K]	$\mathcal{N}(m, s)$	stellar models + spectra	

3. RESULTS

Figure 1. EQTIDE + STELLAR: CPL model**Figure 2.** EQTIDE + STELLAR: CTL model

4. DISCUSSION

5. CONCLUSION



APPENDIX

REFERENCES