donor mass (Rappaport et al. 1995). Such a form is expected to work best for core masses higher than the estimated mass of KOI-81b. Note, however, that both v2010's expression and Equation (3) are approximate. If *Kepler* identifies many similar systems and mass measurements are possible for a significant subset, we will learn how to best model the radii of stars with low-mass cores.

There is a benefit in utilizing the significant contribution of the donor mass to the radius by invoking Equation (1). Specifically, the measured value of the orbital period constrains a combination of both M_* and M_c. This provides input for binary evolution calculations which can identify all possible initial states for the binary we observe today. We start by computing the amount of mass lost by the donor during phase 2: $\Delta = M_* - M_c$; and the fraction of this mass accreted by the blue straggler: $\beta = (M - M_*)/\Delta$, where M is the present-day mass of the monitored star. We can then derive the initial state by evolving backwards in time. We find the range of possible evolutionary paths by sampling a range of values for (1) η and for (2) β during phase 1.[2] Typical results are shown in the bottom panels of Figure 1. The initial mass of the primary can be as high as $\sim 3\,M_\odot$, or as low as $\sim 1.7\,M_\odot$. These differences have detectable consequences, in that more mass is ejected from the binary when $M_1(0)$ is high. Observations can therefore test the predictions of each evolutionary channel, for example the white dwarf's age and the amount of mass ejected from the binary as a function of time.

The results of KOI-74 are shown in the panels on the right hand side of Figure 1. Using our model, we find that the mass of KOI-74b lies in the range: $0.142 - 0.153\,M_\odot$. This is marginally consistent with the results of R2010, based on tidal effects ($0.111^{+0.034}_{-0.038}$). On the other hand, our estimate is smaller than vK2010's Doppler-boost measurements ($0.22 \pm 0.03\,M_\odot$), and also lower than predicted by their period/core-mass relationship ($0.20 \pm 0.03\,M_\odot$). (Note that when the core mass is smaller, the main-sequence contribution to the donor's radius is more significant.) The same general features of the range of initial stars that we discussed for KOI-81 also apply to KOI-74, but the lower mass of today's monitored star is consistent with lower initial masses for the components of the binary.

2.3. Disruption: KOI-74?

If the masses of KOI-74b and KOI-81b are in the range $0.1 - 0.3\,M_\odot$, then the work we sketched above shows that there are binary evolution models in which their progenitors

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[2] β during phase 1 is generally smaller than during phase 2 because there is a mismatch between the thermal time scales of the primary and secondary.