## 3. Probability

The advent of a new observing capability has almost always led to unanticipated discoveries. The two binaries, KOI-74 and KOI-81, may be examples. Nevertheless, we may question whether the evolutionary models presented above are expected to occur commonly enough that *Kepler* should have been able to discover these interesting binary systems by monitoring only $\sim 150,000$ stars. We therefore conducted a first-principles study of binaries in a stellar population to predict the numbers of transiting systems we expect to be comprised of a main sequence star orbited by a white dwarf that has emerged from an episode of mass transfer. Although these calculations were suggested by the discoveries of KOI-74 and KOI-81, they do not rely on the interpretation of these systems. We note that the evolution of interacting binaries consisting of a main sequence accretor and a subgiant or giant donor is complex and involves a wide range of physical processes. There are uncertainties, including the results of common envelope evolution, the fraction of incoming matter that can be retained by the accretor, and the angular momentum evolution of the system. Nevertheless, by parameterizing the effects of these processes we are able to derive a robust conclusion.

The *Kepler* team selected targets from roughly half a million stars in its field brighter than 16th magnitude. More than 90% of the targets were selected based on signal-to-noise considerations that suggested the possibility of detecting terrestrial-size planets. While a small fraction of the targets are selected to pursue a range of other science opportunities, including. e.g., eclipsing binaries and high-proper-motion stars, the majority of the targets ($\sim 90,000$) are G-type stars on or near the main sequence (Batalha et al. 2010). The presence of KOI-74 and KOI-81 illustrates the presence of more massive main-sequence stars as well.

In the calculations described below, we compute the fraction of monitored stars transited by white dwarfs per year. The number of systems in which transits can be detected is the product of this fraction and the number of monitored stars with high enough signal-to-noise that the transits of white dwarfs can be detected. Massive white dwarfs have radii comparable to the radius of the Earth. Transits of many of the *Kepler* target stars by objects of this size should be detectable. The white dwarf radius increases with decreasing mass (see. e.g., Parsons et al. 2010), so the less massive white dwarfs which are expected to be common among mass-transfer products should also produce detectable transits when they pass in front of 90% of the*Kepler* targets. White dwarfs that have not yet had a chance to cool are even larger. We therefore define a quantity $\mathcal{N}_{mon}^{detect}$, the number of monitored stars against which white dwarf transits can be detected.[3] The value of $\mathcal{N}_{mon}^{detect}$ is roughly

[3]Although $\mathcal{N}_{mon}^{detect}$ is a function of the white dwarf mass and age, this is a relatively small effect. The