

# Physical properties of three short period close binaries: KIC 2715417, KIC 6050116 and KIC 6287172 \*

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**Abstract** We present the physical parameters of three short period close binaries using data observed from the *Kepler Space Telescope*. All of these observations were taken in a single bandpass (which approximates the Johnson *V*-band). Our three systems are KIC 2715417, KIC 6050116 and KIC 6287172. The first system, KIC 2715417, is considered a semi-detached system with the secondary component filling its Roche lobe. The second system, KIC 6050116, is an overcontact system, while the third system, KIC 6287172, belongs to ellipsoidal variables as deduced from the Roche lobe geometry. For photometric analysis, we used the PHOEBE software package, which is based on the Wilson–Devinney code. Due to lack of spectroscopic data, the photometric mass ratios are determined from the analyses of light curves using the *q*-search method. The absolute parameters are determined using three different methods (Harmanec, Maceroni & Van’tVeer and Gazeas & Niarchos).

**Key words:** stars: binaries: eclipsing — stars: fundamental parameters — stars: luminosity function, mass function — stars: individual (KIC 2715417, KIC 6050116 and KIC 6287172)

## 1 INTRODUCTION

We have many types of close binary systems as a result of close binary evolution. These types can be classified as follows:

The type called semi-detached systems is found to have the surfaces of the low mass components in contact with the inner Lagrangian surfaces (the critical potential surfaces) and the surfaces of the more massive components are bounded within a separate equipotential surface. In Beta Lyrae systems, where one of the two components has become a giant or supergiant in the course of its evolution, matter can escape from the critical potential surface at which the gravitation at their surface is so weak that material can be transferred to the other component. W UMa type or late type contact systems have both of their components filling the inner Lagrangian surfaces and share a common envelope. Ellipsoidal variables (ELVs) can be described as very close binaries with the two components having non-spherical shapes (ellipsoidal shapes)

due to their mutual gravitation. These binary systems can be considered as close binaries for the following reasons:

Close binaries have short periods. The distance separating the two components is comparable to their size. The two components are close enough that their shapes are distorted by mutual gravitational forces to non-spherical shapes such as in the type known as ELVs. The surfaces of both components overflow their critical Lagrangian surfaces and share a common envelope such as in the case of an overcontact type. When one of their two components becomes giant or supergiant in the final stages of its evolution, matter may freely flow from one component to the other as in the case of the Beta Lyrae type.

### 1.1 Observations

*Kepler* is a space telescope launched by NASA on 2009 March 7 to discover extrasolar planets orbiting around other stars in the field of the constellation Cygnus. *Kepler* has a primary mirror 1.4 meters in diameter. The field of view of the *Kepler* spacecraft is  $105 \text{ deg}^2$ . The photometer

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\* Discovered by the *Kepler Space Telescope*