

## Finding Eclipsing RR Lyrae

In Figure 1 I plot the eclipsing RR Lyrae found in Ogle. When you subtract out the RR Lyrae component (by using a smoother), the residuals look a lot like a binary (left three plots are original source, right three plots are residuals). This is very uncommon, most RR Lyrae don't look like eclipsing binaries when you look at their residuals.

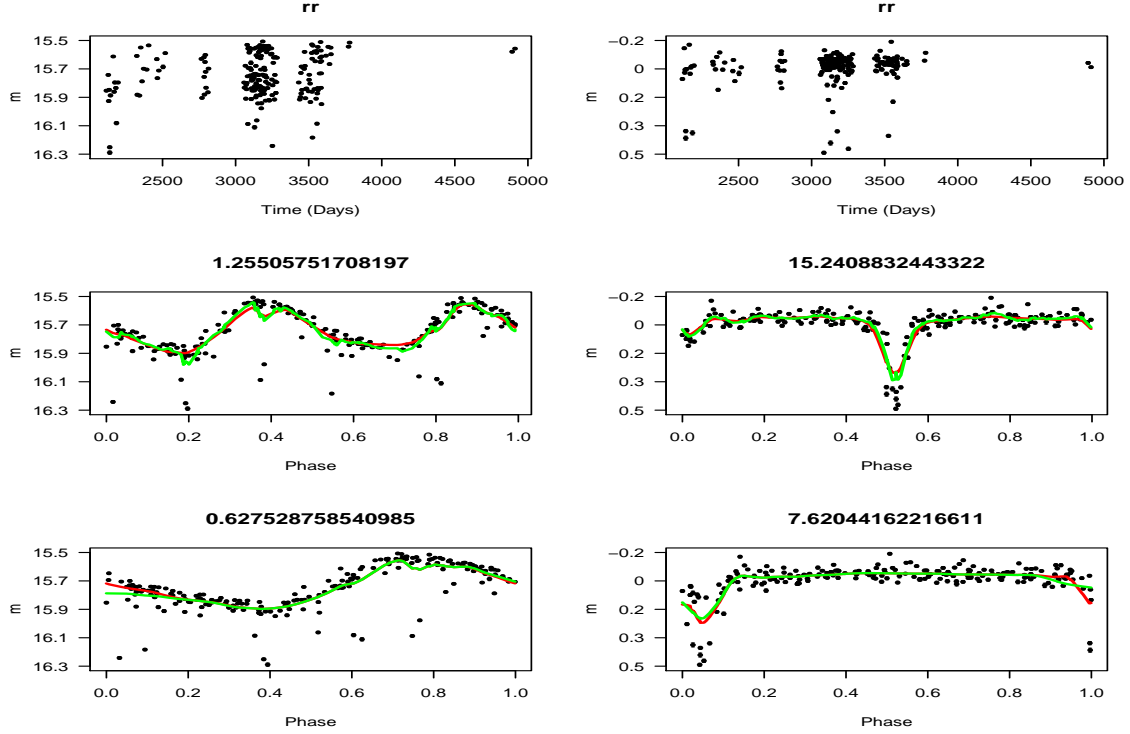


Figure 1: Eclipsing RR Lyrae. Three left plots are original light curve. Three right plots are after subtracting out RR Lyrae Component.

With this in mind, I ran the following procedure:

1. Get 500 RR Lyrae AB in Galactic plane from OGLE. Also get the one known eclipsing RR Lyrae AB (it is also in the Galactic plane).
2. Derive features for the RR Lyrae. Compute residuals = original curve - the periodic variation.
3. Derive features for the residuals
4. Also derive features for around 300 eclipsing debosscher sources (couldn't find any eclipsing category in OGLE)
5. Run a random forest classifier of (Class 1: RR lyrae residuals) versus (Class 2: Debosscher eclipsing)

My thought was that Random forest would separate these classes easily, except for possibly eclipsing RR Lyrae whose residuals will look like the Debosscher eclipsing sources. Below I plot the probability of eclipsing for the RR lyrae residuals and the Debosscher sources with some random scatter on the y-axis for readability.

So it looks like this method separates the ordinary RR lyrae from the single known eclipsing RR Lyrae. I'm thinking of scaling this up to run on all of the RR Lyrae in OGLE ( $\sim 40,000$ ) to see if any more have this very peculiar behavior. Any thoughts?

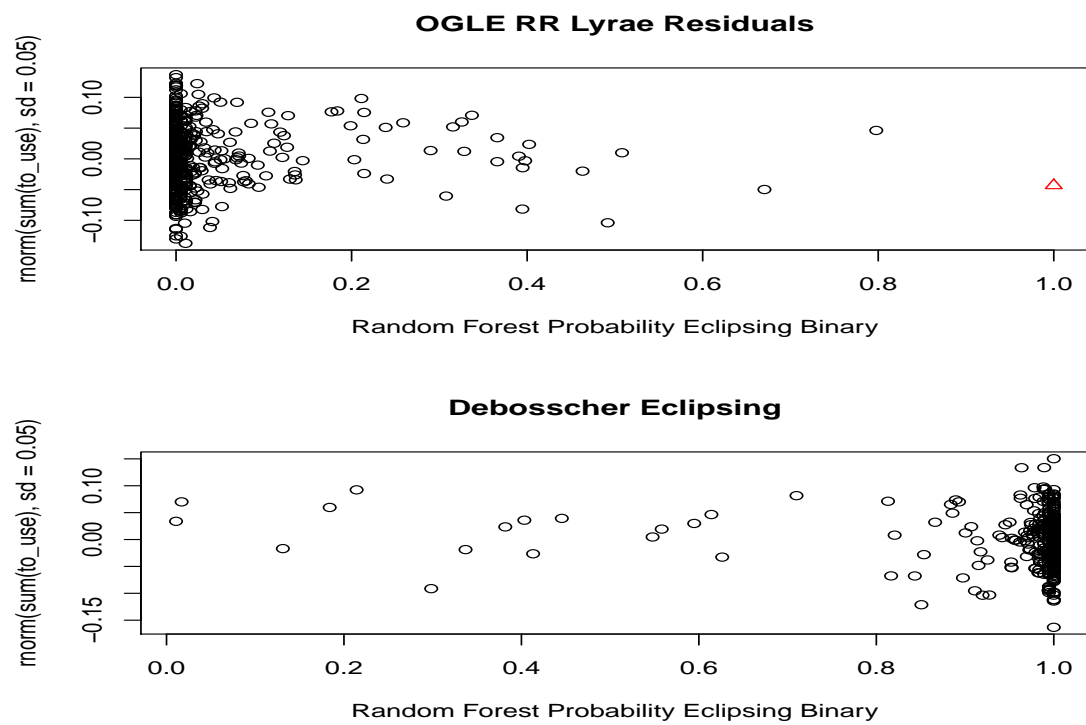


Figure 2: The red point in the eclipsing RR lyrae. The residuals light curve looks much more eclipsing like than any other RR lyrae.