

RR Tau and associated nebula – a project for the VSS and Deep Sky Section.

Each year the BAA Handbook contains a 'Variable Star of the Year', and for 2013 the star chosen is the Herbig Ae/Be star RR Tau (details of which can be read in the 2013 Handbook). RR Tau also provides us with a good opportunity to monitor its associated nebula - GN05.36.5.0. With this in mind a new project is planned along with members of the Deep Sky section to monitor brightness changes (if any) in the nebula, and of course the nightly variations in RR Tau itself.

Although the immediate area of RR Tau is immersed in the faint nebulosity which is GN05.36.5.0, the bright knot just a few arc seconds east of the variable is the brightest part and the area suspected of showing magnitude variations (Fig. 1). It's quite small in size $\sim 7'' \times 10''$, and quite faint. Roger Pickard made some initial measures in March 2012, and recorded the nebula as magnitude $V=17.0$, so it's quite a test for imagers and photometrists.

The variability of the nebula was discovered by George Herbig in the late 1950's, but since that time it would appear that no further studies have been made to determine just how variable the nebula is, or whether the variations correlate with the variability of RR Tau itself. Unlike its close cousin T Tau (associated with the ghostly Hinds Variable Nebula of course), whose variations are *probably* caused by disc instabilities or physical processes in the outer regions of the star itself, the variations we see in RR Tau are almost certainly caused by obscuration events – clouds of 'dust' blocking the light of the star as seen from Earth. This would suggest that any variations detected within the nebula would be a reflection on the intrinsic changes happening within RR Tau itself. The light variations in RR Tau are also much more dynamic than T Tau, with a visual magnitude range of 10.0-14.5 over as little as 90 days or so, compared to T Tauri's range of 9.0-11.5 over the past 50 years.

The aim of the project is simple. Visual VSS observers will monitor the changes in brightness of RR Tau, whilst CCD observers – both VSS and Deep Sky - will attempt to image the nebula on as many occasions as possible, so that we can at the end of the project correlate the two to see if we have anything interesting to show for our efforts. Even if we don't, we will still have answered an important question!

The observing season for RR Tau runs from late September to early May, with gaps for a few days each month due to the presence of the Moon. Photometric measurements of the nebula can be made with software such as AIP4WIN, as it can be treated as an out of focus star because of its small size. Short exposures stacked are recommended to save saturation from RR Tau itself, especially if the star is at its brightest phase. Roger will be happy to give advice on how to do this if required. It is also advised that the same instrument and exposure times are used each time an observation is made, as it has been seen with other variable nebulae projects that variations in instrument choice and exposure time result in data which is difficult to interpret when it comes to attempts at measuring brightness changes in these objects. Observations of RR Tau should of course be reported to the database using the relevant spreadsheets, but photometric measures of the nebula should be sent to me along with any images you take. The project will be ongoing for several observing seasons.

RR Tau can be found at these 2000.0 coordinates 05 39 30.51 +26 22 27.0.

The project opens up an area where both the VSS and DSS can work together to find out whether this nebula is truly variable, and I hope that as many of you as possible will take part.

Gary Poyner
garypoyner@blueyonder.co.uk



Fig. 1 Digitised Sky Survey colour image of RR Tau and it's associated nebula. The variable nebula can be seen as a bright 'knot' of nebulosity just east of RR Tau itself (centre star). 4.9"x5.5" (CDS Aladin v7.0)

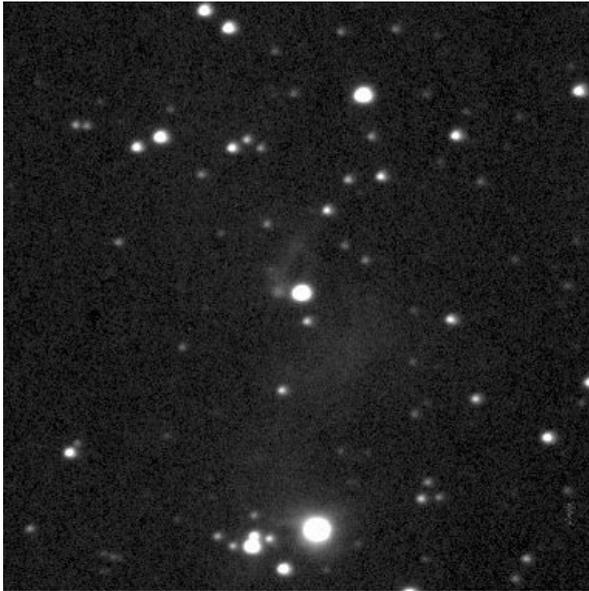


Fig. 2 Image of RR Tau and nebula. 50x60 second exposures. 35cm F10 SCT. *Roger Pickard*