CARBON STARS AND SILICON CARBIDE

Adrian Corman

Dr. Angela Speck, Dissertation Supervisor

ABSTRACT

Stars between about 0.8 and 8 times the mass of the Sun will eventually evolve become asymptotic giant branch (AGB) stars, where they pulsate and throw off mass from their atmospheres, forming dust shells in the space around them. AGB stars between about 2 to 4 solar masses can develop atmospheres that have an overabundance of carbon relative to oxygen (thus becoming carbon stars), which results in their dust shells containing mineral species dominated by carbonaceous compounds. One of these, silicon carbide (SiC) has been extensively investigated in an attempt to discover the conditions present in these dust shells. In this work, we investigate the nature and uses of SiC for astronomical research, and in particular what SiC can tell us about the dust shells around carbon stars. We investigate the SiC feature found in a collection of carbon stars, and then do the same for an additional set of 'extreme' carbon stars which are very close to the end of their lives. We investigate a single carbon star, V Cyg, in more detail, looking at the changes in the dust shell as functions of both position and time. We then examine existing optical constants for SiC, and obtain a new set of optical properties that eliminates limitations in the older data. Finally, we use small-particle absorption and scattering theory to produce a program which allows us to apply commonly used shape and size parameters to these new optical properties for use in radiative transfer modeling.