

INVESTIGATING THE FORMATION MECHANISM OF POLYCYCLIC AROMATIC HYDROCARBONS

AND

ADAPTING PARTICLE SWARM OPTIMIZATION TECHNIQUES TO SEARCH LARGE DATA SETS

Daniel P. Caputo

Dr. Angela Speck, Thesis Supervisor

ABSTRACT

The unidentified infrared bands (UIBs) have been attributed to emission from polycyclic aromatic hydrocarbons (PAHs). The UIBs at 3.3 and 11.3 μm , among others, are seen in many astrophysical environments, with the notable exception of carbon-rich AGB stars (C stars). PAHs are expected to form around C stars, yet only a few show the UIBs and all of these have hot companions. This makes C stars with hot companions an ideal environment to study the conditions associated with PAH formation and processing. We present new observations, taken using the Gemini North telescope, of several C stars with hot companions in order to understand the distribution of PAHs responsible for the emerging UIB emission.

As the size of data and model sets continue to increase, more efficient ways are needed to sift through the available information. We also present a computational method which will efficiently search large parameter spaces to either map the space or find individual data/models of interest. This is done through a heavily modified Particle Swarm Optimization algorithm.