

# Anthony Smith, Physics and Math

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## **Radiative transfer modeling of low to intermediate mass stars**

*Anthony Smith and Angela Speck*

Most stars in the universe, ~95%, are low to intermediate mass stars (LIMS), meaning that their masses range from 0.8 to 8 solar masses. When these stars near the end of their lives, they enter the AGB phase during which they return a significant percentage of their mass to the interstellar medium (ISM) as dust. A good understanding of the nature of what the LIMS return to the ISM is essential in understanding how the ISM behaves. As gas drifts away from the star, it condenses into dust forming shells around the star. As starlight passes through this dust, it can be absorbed and/or scattered differently depending on the nature of the dust leading to a change in the spectrum of light seen from the star. We can then use this spectrum to diagnose the nature of the dust shell. The spectra of these stars/dust shells can be divided in categories according to the shape and strength of the spectral features. The oxygen-rich LIMS are divided into eight spectral classes based on how broad or narrow the silicate feature is; where SE1 has the broadest feature and SE8 the narrowest. Using a computer program, called DUSTY, a 1-dimensional radiative transfer code that solves the spherical radiative transfer problem, we alter the parameters that describe the dust shell such as its size, density, composition, crystal structure, and the size/shape of the dust grains. DUSTY then produces synthetic spectra which are matched to observed spectra. We aim to match the eight spectral classifications of oxygen-rich LIMS by comparing them to DUSTY models produced using laboratory acquired optical constants of candidate dust species. These results will constrain the composition, size, shape and other characteristics of the dust that the star is scattering back into the ISM. The dust grains cast into the ISM are the building blocks for new stars and planets and our understanding of this dust is crucial to our understanding of galactic chemical evolution.