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Lust for rusty dust: An investigation of MgFeOs around AGB stars with a 13 μ m feature

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Circumstellar dust is the key to understanding the cosmos. Circumstellar dust forms around a star from the newly-formed elements ejected by the star. The constituent particles of the dust are determined by processes deep within the star. Of these fundamental particles, some form bonds becoming molecules which clump together to form dust grains. The composition, size, shape, and temperature of the dust grains depend on the nature of the star. Dust escaping from the star goes into the interstellar medium (ISM) where it is exposed to different conditions. Determining the composition of circumstellar dust yields information about the environment in which the dust is created, the chemical processes occurring within the parent star, and how the dust is changed in the ISM. Oxygen-rich asymptotic giant branch (AGB) stars that have spectral emission features in the 5-20 μ m range which can be subdivided into eight spectral classes based on flux ratios $F_{10\mu\text{m}}/F_{11\mu\text{m}}$ plotted against $F_{10\mu\text{m}}/F_{12\mu\text{m}}$. This classification yields eight classes ranging from broad (SE1) to narrow/sharp (SE8; SE for Silicate Emission) 10 μ m features. In addition to classification based on emission around 10 μ m, largely attributed to silicate dust, there is an enigmatic feature at ~13 μ m which appears in ~50% of these stars' spectra, the major difference being the occurrence of the 13 μ m feature and some extra emissions in the ~15-22 μ m region. The focus of the research is to understand what causes the difference in the 15-22 μ m region. Models are created using a computer program, DUSTY, which solves the radiative transfer equation and outputs a spectral model. DUSTY manipulates parameters relevant to dust formation around stars, including varying optical constants. Optical constants describe the wavelength-dependent interaction between dust grains of a certain size, composition, and crystal structure. By varying the optical constants used by DUSTY, we can model the observed O-rich AGB star spectra.