

The Dusty Evolved Star Kit (DESK): A Python package for fitting the Spectral Energy Distribution of Evolved Stars

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Software

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Summary

One of the few ways that we can understand the environment around dusty stars and how much material they contribute back to the Universe, is by fitting their brightness at different wavelengths with models that account for how the energy transfers through the dust. Codes for creating models have been developed and refined (Elitzur & Ivezić, 2001; Ueta & Meixner, 2003), but a code for easily fitting data to grids of realistic models has been up-to-this-point unavailable.

The DESK is a python package that fits photometry or spectra of evolved stars, or the Spectral Energy Distribution (SED), to grids of radiative transfer models using a least-squares method. The package includes newly created grids using a variety of different dust species, and state-of-the-art dust growth grids (Nanni et al., 2019).

Results from these grids (e.g. luminosity, mass-loss rate) can vary dramatically as a result of the unknown properties of evolved stars, especially the oxygen-rich Asymptotic Giant Branch (AGB) stars (Goldman et al., 2017; Srinivasan, Sargent, & Meixner, 2011). It is also a challenge to compare results as they are calculated based on measured values of the dust (optical constants) which can not be interpolated over. To understand the ranges and estimated errors of fitted results, they must be compared to results from different model grids.

This package is designed to easily compare stellar samples and model grids for a better understanding of the results and their uncertainties. The package can be installed using pip and, using “entrypoints”, can be accessed from any terminal prompt once installed. The fitting method uses a brute-force technique to ensure a true best fit. Grids of radiative transfer models can easily be created and added to the model grid library.

Figures

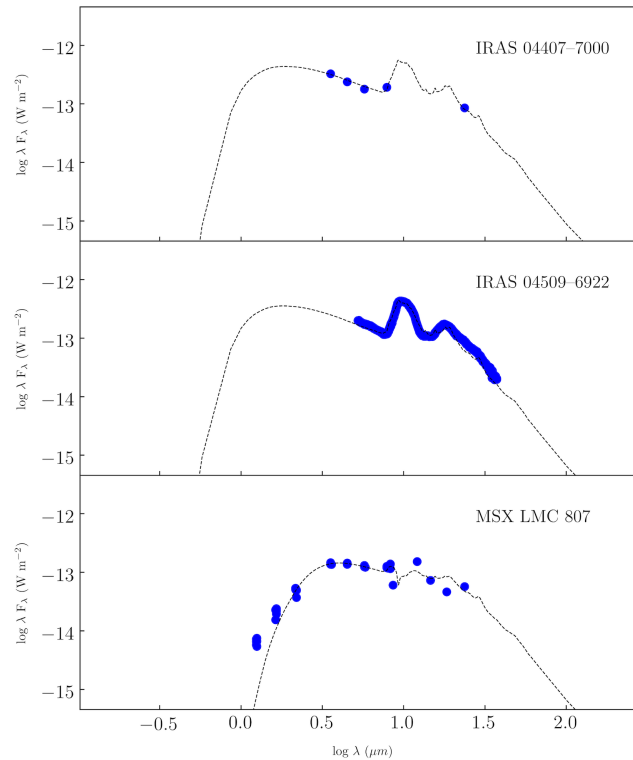


Figure 1: An example figure of sources fit with an oxygen-rich grid.

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