Why Galaxies Care About AGB Stars: A Continuing Challenge through Cosmic Time
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Dust Structure Around Asymptotic Giant Branch Stars

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Abstract. This paper presents mass, temperature profile, and the variation of Planck's function in different regions around asymptotic giant branch (AGB) stars. The physics of the interstellar medium (ISM) is extremely complex because the medium is very inhomogeneous and is made of regions with fairly diverse physical conditions. We studied the dust environment such as flux, temperature, mass, and inclination angle of the cavity structure around C-rich asymptotic giant branch stars in 60 μm and 100 μm wavelengths band using Infrared Astronomical Survey. We observed the data of AGB stars named IRAS 01142+6306 and IRAS 04369+4501. Flexible image transport system image was downloaded from Sky View Observatory; we obtained the surrounding flux density using software Aladin v2.5. The average dust color temperature and mass are found to be 25.08 K, 23.20 K and 4.73 $\times$ 10^{26} kg (0.00024 $M_\odot$), 2.58 $\times$ 10^{28} kg (0.013 $M_\odot$), respectively. The dust color temperature ranges from 18.76 K $\pm$ 3.16 K to 33.21 K $\pm$ 4.07 K and 22.84 K $\pm$ 0.18 K to 24.48 K $\pm$ 0.63 K. The isolated cavity like structure around the AGB stars has an extension of 45.67 pc $\times$ 17.02 pc and 42.25 pc $\times$ 17.76 pc, respectively. The core region is found to be edge-on having an inclination angle of 79.46° and 73.99°, respectively.

Keywords. Stars: AGB and post-AGB – mass-loss – circumstellar matter – dust – ISM: dust

1. Introduction

The interstellar medium (ISM) is the low density matter space between stars. It contains by mass 99% gas and 1% dust particles. The percentage of gas particles is 91% hydrogen, 9% helium and 0.1% are the atoms of elements heavier than hydrogen and helium. In this research work, we discuss how mass is distributed around the AGB stars, the temperature distribution and the structure of regions of dust around the AGB stars which forms near the cavity like structure and gives a wide range of area for the interaction between ISM and an AGB star. Aryal *et al.* (2006) studied nebulae and Jha *et al.* (2017) have done research work about KK loops and ATNF pulsars. Here, we have presented work related to asymptotic giant branch stars by using similar methods. We have investigated the surrounding temperature, mass and cavity around the C-rich AGB stars at a distance 4.49 kpc and 4.92 kpc using the paper by Guandalini *et al.* (2006). This research has made use of the SIMBAD (http://simbad.u-strasbg.fr/simbad/sim-fcoo (2018)) database and cross checked from SkyView Virtual Observatory (http://skyview.gsfc.nasa.gov/current/cgi/query.pl (2018)) respectively, using data reduction software like Aladin v2.5, Aladin v10 and other software, Origin 5.0 and 8.0, etc. and we obtained different phenomena regarding AGB stars. This work has been done using a formulation for dust color estimation by Schnee *et al.* (2005) and Dupac *et al.* (2005)

‡ The original version of this article was published with incorrect author information. A notice detailing this has been published and the error rectified in the online PDF and HTML copies.

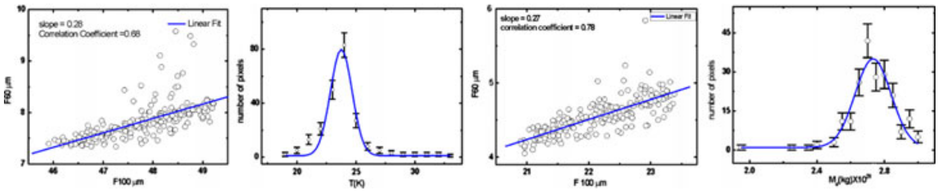

Figure 1. From left to right: flux at 60μm vs 100μm, Gaussian distribution of dust color temperature of star IRAS 01142+6306, flux at 60μm vs 100μm, and dust mass distribution of IRAS 04369+4501.

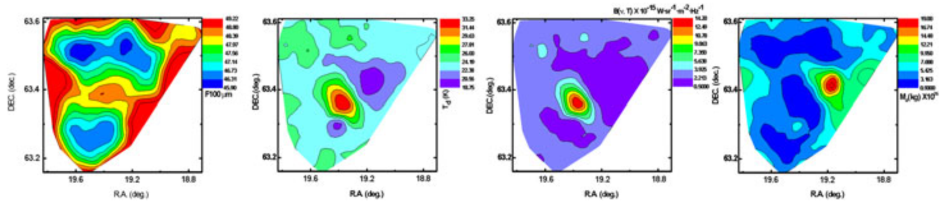

Figure 2. From left to right: flux, dust color temperature, intensity of radiation, and dust mass distribution contour plot, which follows expected trends i.e. mass is nearly inversely to the temperature distribution whereas the intensity of radiation is following temperature.

whereas for dust mass and for inclination angle we have extensively used Young *et al.* (1993) and Holmberg *et al.* (1946) theoretical work, respectively.

2. Results & Discussion

The maximum, minimum and average temperature of the ambient ISM around the AGB stars are found to be 33.21 K ± 4.06 K, 18.76 K ± 3.16 K, 25.08 K and 22.84 K ± 0.18 K to 24.48 K ± 0.63 K and 23.20 K, respectively. From more and less difference in temperature we realized that the stars are in the late and early AGB phase, respectively, whereas total mass and mass per pixel around AGB stars are found to be 1.04×10^{29} kg (0.52 $M_{\odot}$), 4.73×10^{26} kg (0.00024 $M_{\odot}$) and 5.156×10^{30} kg (2.58 $M_{\odot}$), 2.58×10^{28} kg (0.013 $M_{\odot}$), respectively. The inclination angle of the core region of IRAS01142+6306 and IRAS04369+450 are found to be 79.46° and 73.99°, suggesting edge-on appearance whereas sizes of the structures are found to be 45.67 pc × 17.02 pc and 42.25 pc × 17.76 pc, respectively.

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