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Calculation of Dust Production by Long-Period Variable Stars in the Galaxy NGC 6822

Hamidreza Mahani¹, Atefeh Javadi^{*1}, Hedieh Abdollahi^{1,2}, and Fatemeh Khatamsaz¹

1. School of Astronomy, Institute for Research in Fundamental Sciences (IPM), Tehran, 19568-36613, Iran
2. Konkoly Observatory, HUN-REN Research Centre for Astronomy and Earth Sciences, MTA Centre of Excellence, Konkoly-Thege Miklós út 15-17, H-1121, Budapest, Hungary

E-mail: Atefeh@ipm.ir

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Abstract

Mass loss from evolved stars, particularly long-period variable stars (LPVs), plays a critical role in enriching the interstellar medium and contributing to galactic evolution. This study investigates the mass-loss rates of LPVs in the irregular dwarf galaxy NGC 6822 using infrared data from ground-based telescopes in the wavelength range of 1.2 to 2.2 micrometers and data from the *Spitzer* Space Telescope at 3.6 and 4.5 micrometers. By deriving the spectral energy distributions of these stars and analyzing their radiative properties, the overall mass-loss rates of carbon-rich and oxygen-rich stars were determined. The results indicate a total mass-loss rate from LPVs of approximately $2.7 \times 10^{-5} \text{ M}_{\odot} \text{ yr}^{-1}$, with dust production contributing roughly $3.7 \times 10^{-9} \text{ M}_{\odot} \text{ yr}^{-1}$, while the remainder is attributed to ejected gas. Furthermore, oxygen-rich and carbon-rich stars contribute 22% and 78%, respectively, to the total mass loss of LPVs. Given the low metallicity of this galaxy, the dominant role of carbon-rich stars in the production of interstellar dust is expected. Considering the estimated current star formation rate in the bar region of NGC 6822, reported as $1.7 \times 10^{-2} \text{ M}_{\odot} \text{ yr}^{-1}$, the findings suggest that the mass returned by LPVs is insufficient to provide the interstellar material required to sustain ongoing star formation in this galaxy.

Keywords: Evolved stars, Dust, Local Group, Dwarf galaxy, Irregular galaxy, Spectral energy distribution

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