Dust-enshrouded giants in clusters in the Magellanic Clouds

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We present the results of an investigation of post-Main Sequence mass loss from stars in clusters in the Magellanic Clouds, based around an imaging survey in the L'-band (3.8 micron) performed with the VLT at ESO. The data are complemented with JHKs (ESO and 2MASS) and mid-IR photometry (TIMMI2 at ESO, ISOCAM on-board ISO, and data from IRAS and MSX). The goal is to determine the influence of initial metallicity and initial mass on the mass loss and evolution during the latest stages of stellar evolution. Dust-enshrouded giants are identified by their reddened near-IR colours and thermal-IR dust excess emission. Most of these objects are Asymptotic Giant Branch (AGB) carbon stars in intermediate-age clusters, with progenitor masses between 1.3 and about 5 Msun. Red supergiants with circumstellar dust envelopes are found in young clusters, and have progenitor masses between 13 and 20 Msun. Post-AGB objects (e.g., Planetary Nebulae) and massive stars with detached envelopes and/or hot central stars are found in several clusters. We model the spectral energy distributions of the cluster IR objects, in order to estimate their bolometric luminosities and mass-loss rates. The IR objects are the most luminous cluster objects, and have luminosities as expected for their initial mass and metallicity. They experience mass-loss rates in the range from a few 1e-6 up to 1e-4 Msun/yr (or more), with most of the spread being due to evolutionary effects and only a weak dependence on progenitor mass and/or initial metallicity. About half of the mass lost by 1.3--3 Msun stars is shed during the superwind phase, which lasts of order 1e5 yr. Objects with detached shells are found to have experienced the highest mass-loss rates, and are therefore interpreted as post-superwind objects. We also propose a simple method to measure the cluster mass from L'-band images.

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