ISOGAL survey of Baade’s Windows in the mid-infrared

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Abstract

The ISOGAL mid-infrared survey of areas close to the Galactic plane aims to determine the stellar content of those areas, and its possible bearing on the history of the Galaxy. The NGC 6522 and Sgr I Baade’s Windows of low obscuration towards the inner parts of the Galactic bulge represent ideal places in which to calibrate and understand the ISOGAL colour–magnitude diagrams, which are more difficult to interpret in heavily reddened fields.

The survey observations were made with the ISOCAM instrument of the ISO satellite. The filter bands chosen were LW2 (∼7 μm) and LW3 (∼15 μm).

The results presented here show that most of the detected objects are late M-type giants on the asymptotic giant branch (AGB), with a cut-off for those earlier than M3–M4. The most luminous members of these two bulge fields at 7 μm are the Mira variables. However, it is evident that they represent the end of a sequence of increasing 15-μm dust emission which commences with M giants of an earlier sub-type.

In observations of late-type M giants, the ISOCAM 15-μm band is mainly sensitive to the cool silicate or aluminate dust shells which overwhelm the photospheric emission. However, in ordinary M-giant stars, the 7-μm band is not strongly affected by dust emission and may be influenced instead by absorption. The ν2 band of water at 6.25 μm and the SiO fundamental at 7.9 μm are likely contributors to this effect. Miras are more luminous at 7 μm and have redder K0–[7] colours than other M giants. Their [7]–[15] colours are consequently bluer than might be expected by extrapolating from warmer M giants.

A group of late-M stars has been found that vary little or not at all, but have infrared colours typical of well-developed dust shells. Their luminosities are similar to those of 200–300 day Miras, but they have slightly redder [7]–[15] colours which form an extension of the ordinary M-giant sequence. They may belong to the class of red semi-regular variables.

The Mira dust shells show a mid-infrared [7]–[15] colour–period relation.

In these two fields there is no component of high-luminosity late-type variables obscured at K and shorter wavelengths such as is seen in the Magellanic Clouds. The upper limit of long-period variable (LPV) periods in these fields remains at approximately 700 d.

Key words: stars: AGB and post-AGB – stars: variables: other – Galaxy: centre – Galaxy: stellar content – infrared: stars.

1 Introduction

The ISOGAL1 (Péroux et al. 1996; Ojha, Omont & Simon 1997; Omont et al. 1999 a,b, and in preparation) project has surveyed a number of fields at low galactic latitude in the intermediate infrared using the ISOCAM (Cesarsky et al. 1996) instrument of the ISO2 satellite. Its aim is the better understanding of the stellar content of the inner Galaxy, mostly in very obscured regions. Normally, the filter bands chosen for the observations were LW2 (5.5–8 μm) and LW3 (12–18 μm). The pixel size was 6 × 6 arcsec2.

The dusty shells surrounding mass-losing late-type stars are

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