Far-infrared observations of evolved stars measured with ISOPHOT in mini-map mode

Attila Moór, Péter Ábrahám, Csaba Kiss, Szilárd Csizmadia

Konkoly Observatory, Budapest, Hungary
31-Januar-2004

Version 1.0

1 Introduction

The mini-map observing mode was one of the most efficient ways of obtaining point source photometry with the ISOPHOT C100 and C200 detectors. It was also the mode used for FCS calibration observations. C100 mini-maps are typically 3x3 raster maps performed in satellite coordinate system centered on the source. In the recommended and most frequently used configuration $\Delta M = \Delta N = 46''$ (one detector pixel) in combination with an odd number of raster steps in both directions. For the C200 detector the usual configuration was $\Delta M = \Delta N = 92''$ together with an even number of raster steps. For a discussion of the special features and advantages of this observing mode see our report "Far-infrared observations of normal stars measured with ISOPHOT in mini-map mode" (Moór et al. (2003); hereafter Report I).

In Report I we described the recalibration of the mini-map mode and we compiled a catalogue including recalibrated fluxes of 555 measurements of 229 normal stars. In the present work we (1) collect 53 far-infrared mini-map observations of 50 evolved stars; (2) reprocess them following the scheme developed in Report I; and (3) compile a catalogue from the sample. The results will be available as a Highly Processed Data Product (HPDP) in the ISO Data Archive.

2 Database of evolved stars observed in mini-map mode

In order to create a database of evolved stars we searched the ISO Archive for observations according to the following criteria:

- AOT P22 and P99 rasters with raster step numbers of $2 \leq \mathrm{M} \leq 7$ and $2 \leq \mathrm{N} \leq 7$ for the C100 and $2 \leq \mathrm{M} \leq 6$ and $2 \leq \mathrm{N} \leq 6$ for the C200 detector array;
- raster step sizes in the range $20'' - 70''$ for the C100, and $40'' - 100''$ in the case of the C200 detector;
- target of the observation can be classified as an evolved star (e.g. giant star, Mira, AGB) based on its Simbad information (code for object type or spectral type);

This query resulted in 52 TDT numbers including 53 mini-maps. These measurements belong to 13 different proposals.

3 Data processing

We followed the data reduction scheme as documented in details in Report I.

3.1 Error budget

In the catalogue the flux uncertainties (see Table 1 - Field 15) were derived as a standard deviation of the nine (C100) or four (C200) independent pixel fluxes (for details see Report I).

In order to get a feeling about the typical flux uncertainties we also quantified the standard deviations on the basis of our study for normal stars (for details see Report I). On the normal stars sample the standard deviations of the measured flux vs. predicted flux residuals, computed after the empirical correction, were determined as follows: at low flux level a constant value independent of the source flux was assumed while at high fluxes the uncertainty was expressed as a fraction of the source's flux density, in percentage. At 60, 90 and 170μm suitable number of faint measurements were found for a reliable estimate of low level constant error value. At the other wavelengths the present normal star database turned out to be insufficient to determine such an error.

Filters	Constant error component [mJy]	Multiplicative error component [%]
C50	-	<7
C60	14.5	4
C70	-	<7
C90	14.5	7
C100	-	<7
C105	-	<7
C120	-	<9
C150	-	<9
C160	31	4.5
C180	-	<9
C200	-	<9

4 Description of the catalogue

Column	Field	Unit	Description
(1)	Object name		SIMBAD compatible name. Filled if a compact source from SIMBAD can be associated with the ISOPHOT target without doubt.
(2)	Object type		Standard SIMBAD code for object type
(3)	ISO name		Target name as given by the original ISO proposer
(4)	TDTNUM_ON		The 8-digit TDTNUM of the on-source observation
(5)	On_ Meas.		Index of the on-source measurement within TDTNUM_ ON
(6)	RA(2000)		RAh, RAm, RAs of the ISOPHOT position
(7)	Dec(2000)		DECd, DECm, DECs of the ISOPHOT position
(8)	Detector		ISOPHOT detector (C1 or C2 for C100 and C200)
(9)	Wavelength	[micron]	Nominal wavelength of the ISOPHOT filter
(10)	Aperture	[arcsec]	Square aperture for C100 (43.5 arcsec) and C200 (89.4 arcsec) detectors
(11)	Epoch		Epoch of the observation
(12)	TDTNUM_OFF		The 8-digit TDTNUM of the off-source observation
(13)	Off_Meas.		Index of the off-source measurement within TDTNUM_OFF
(14)	Flux density	[Jy]	Flux density of the source. In case of a point source the measured flux is corrected for the size of the point spread function. In case of an extended source it corresponds to the integrated brightness. No colour correction applied.
(15)	Flux uncertainty	[Jy]	Flux uncertainty. No colour correction applied.
(16)	Background	[MJy/sr]	Background surface brightness. No colour correction applied.
(17)	Detection	[sigma]	The significance level of the source being detected above the background.
(18)	Object size		Indicates if the object is point-like (P) or extended (E)
(19)	Quality		Quality of the observation R1 – Standard processing according to the scheme described in the report. R2 – Minimap performed in astronomical (rather than satellite) coordinate system. R3 – ISOPHOT position differs from SIMBAD position by more than 10” R4 – Suspected ISO pointing problem R5 – Only one FCS is available R6 – No useful FCS is available, default FCS is used R7 – Archive quality mark R8 – Not enough data points to perform drift correction R9 – Fitting smooth baseline to the data points failed, drift correction (partly/completely) omitted R10 – Observation was carried out at the very beginning or at the very end of orbit Reduced photometric reliability at orbital phase lesser than 0.2 or greater than 0.8 R11 – A large increase in the proton flux from the Sun was observed R12 – Non-stabilised target signal R13 – Measured flux was out of the empirically calibrated range

Table 1: Description of the catalogue

References

Moór, A., Ábrahám, P., Kiss, Cs., Csizmadia, Sz., 2003, Far-infrared observations of normal stars measured with ISOPHOT in mini-map mode (http://pma.iso.vilspa.esa.es:8080/hpdp/techn ical_reports/technote5.pdf)
Müller, T.G., Lagerros, J.S.V., 2002, A&A, 381, 324