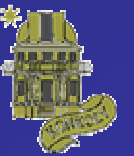
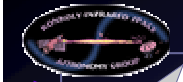
Konkoly Infrared Space Astronomy Group
http://kisag.konkoly.hu

ISO-related activities at Konkoly Observatory 2001-2006

Péter Ábrahám

Konkoly Observatory of the Hungarian Academy of Sciences





Contents

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- ISOPHOT calibration: The EBL project
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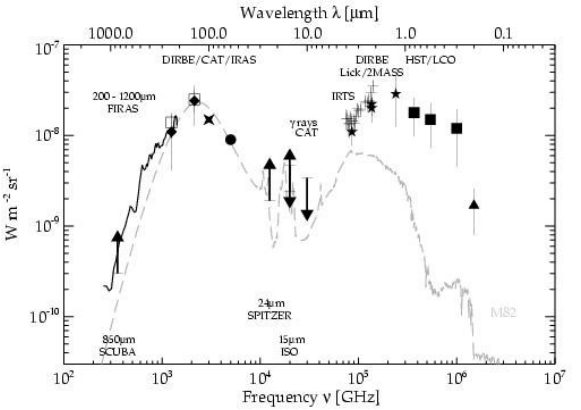
- Married to ISO forever?

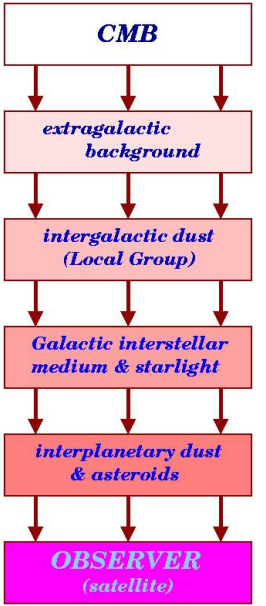
Infrared timeline 2001-2006

- The tracks lead to Heidelberg (participation of 3 Hungarian astronomers in ISOPHOT calibration)
- ISOPHOT Hungarian Subnode (ESA-HSO PRODEX) (2001)
- Living contact to MPIA
- Contract with the ISO Data Centre (R.J. Laureijs, L. Metcalfe, A. Salama) (2002)
- KISAG (2003): project work; post-docs employed for calibration work; attract graduate and PhD students, hold university courses, organize journal club, website, popular talk and articles,…
- Funding: ESA PRODEX and PECS programs, Hungarian Research Fund, German-Hungarian Bilateral Agreement, etc.
- Transition to the Herschel-era (2005 -)

The EBL Project

Motivation: derive the level of Extragalactic Background Light at far-infrared wavelengths





The EBL Calibration Project

ISOPHOT was a carefully designed instrument to measure absolute surface brightness (no straylight).

2001: Comparison of with DIRBE: discrepancies (both scaling and offset).

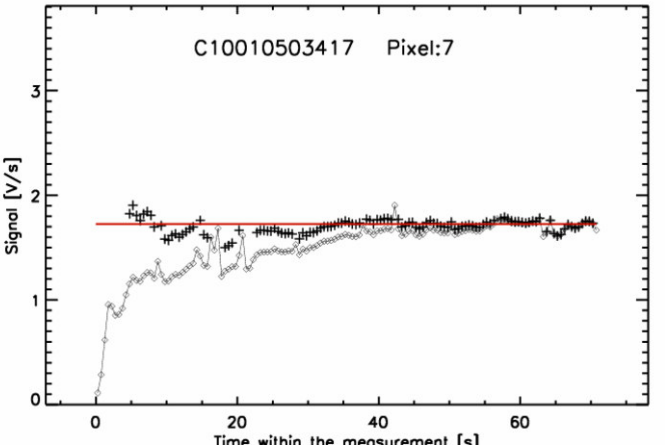
A new calibration programme was defined (MPIA-Konkoly):

- Transient correction
- Reset Interval correction at low signal level
- Re-analysis of dark signal
- Bypassing skylight and FCS measurements
- Footprint analysis
- Surface Brightness calibration
- Signal linearization reconsidered
- FCS heating power curves

Implementation of the new algorithms in Phot Interactive Analysis V11

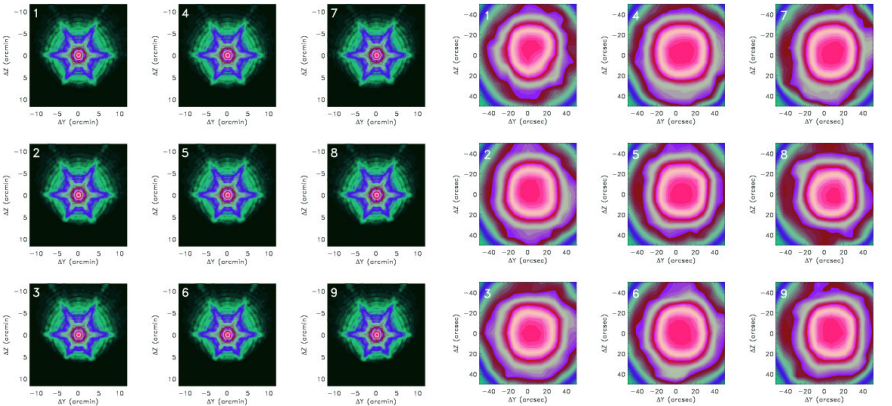
Documentation

ISOPHOT fundamental re-calibration



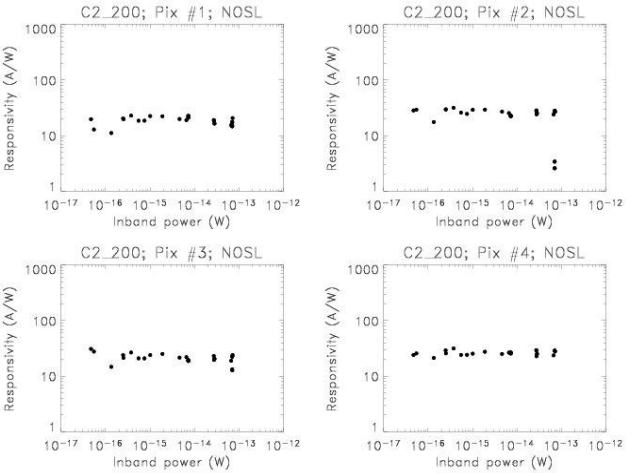
Transient correction

ISOPHOT fundamental calibration



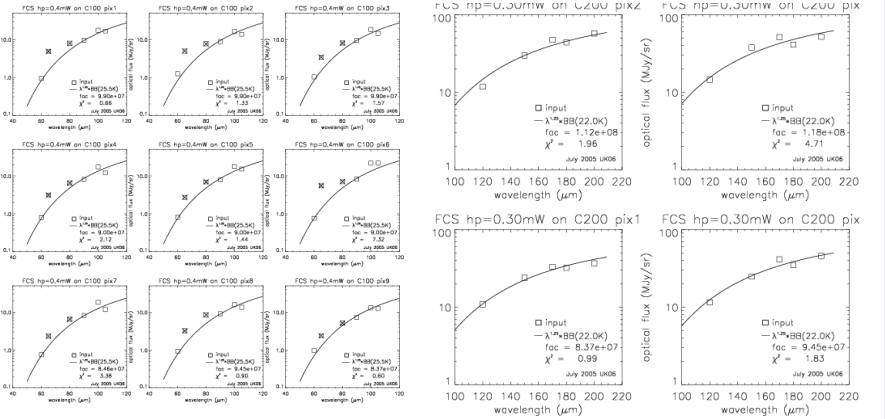
Measured beam profile

ISOPHOT fundamental calibration



No need for signal linearization...

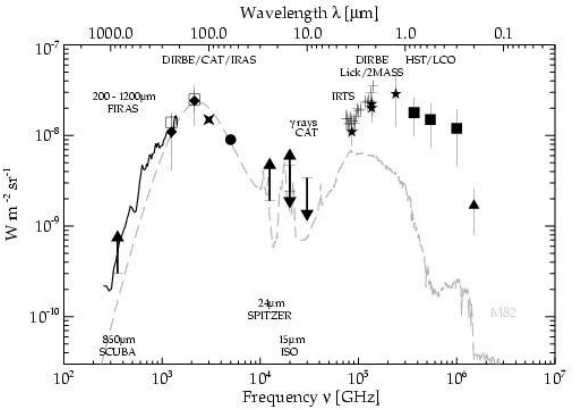
ISOPHOT fundamental calibration

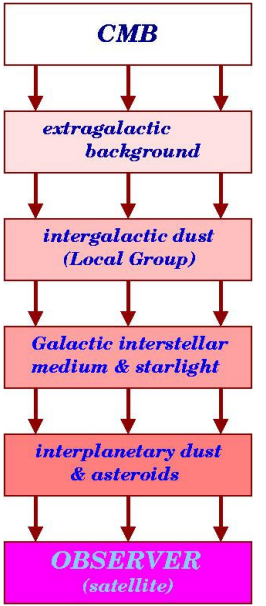


Fine Calibration Source heating power curves

The EBL Project

Motivation: derive the level of Extragalactic Background Light at far-infrared wavelengths





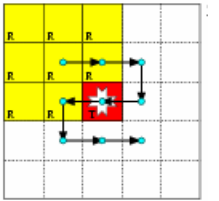
ISOPHOT archive: Production of HPDPs

- Select and process well-defined homogeneous ISOPHOT data sets (not necessarily a complete AOT)
- Utilize science observations of normal stars as secondary standards
- Develop dedicated correction algorithms
- Empirical photometric correction as the final step of processing
- Proceed from one data set to the next one, adapt correction algorithms, use lessons learnt → homogenization of modes
- Produce easy-to-use photometric catalogues (foreseen to be linked to the VO), and atlases (far-IR maps, PHT-S spectrophotometry)

ISOPHOT archive: Production of HPDPs

Far-infrared mini-maps

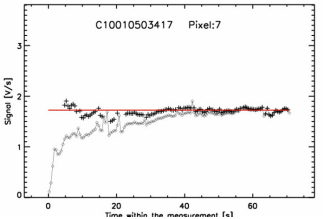
The most efficient observing mode of ISOPHOT
Each pixel provides independent photometric results
ISOPHOT was calibrated in "mini-map mode"
AOT P22



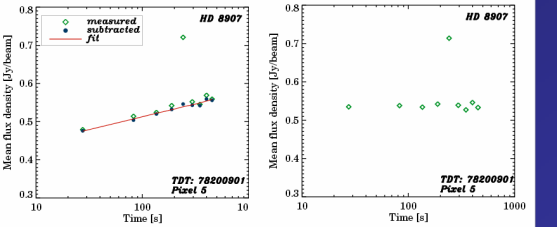
~1380 TDTNUMs
~360 h total time

ISOPHOT archive: Production of HPDPs

Transient correction



Drift correction



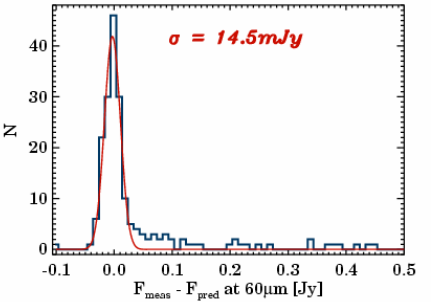
- **Flux reconstruction** using the 2D beam (measured)
- **Empirical photometric correction** (using secondary standards)

ISOPHOT archive: Production of HPDPs

Error budget

Faint level: 14.5 mJy @ 60, 90 μm
31 mJy @ 170 μm
Bright level: better than 7-9%

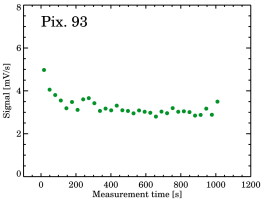
- **Quality flags**
- **Additional checks:** source confusion in the beam;
- Off-centre position; point / extended object;



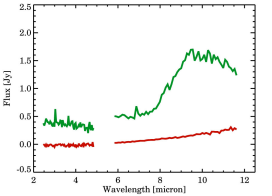
SAO 146062	HD 212320ON90	53500777	00	22	23	32.1	−7	11	40.2	C1	90	43.5	535	53500777	00	0.141	0.064	0.00	0.00	P	R1
SAO 258961	HD 218559ON60	53300493	00	23	12	12.5	−80	54	46.0	C1	60	43.5	533	53300493	00	0.139	0.007	0.00	0.00	P	R1
SAO 258961	HD 218559ON90	53300497	00	23	12	12.5	−80	54	46.0	C1	90	43.5	533	53300497	00	0.131	0.007	0.00	0.00	P	R1
HR 8950	HD 221776ON60	43001203	00	23	34	46.8	38	1	25.7	C1	60	43.5	430	43001203	00	0.541	0.057	0.00	0.00	P	R1
HR 8950	HD 221776ON90	43001207	00	23	34	46.8	38	1	25.7	C1	90	43.5	430	43001207	00	0.234	0.037	0.00	0.00	P	R1

ISOPHOT archive: PHT-S post-processing

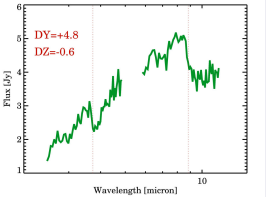
Most PHT-S spectra in the Legacy Archive are OK, but some individual cases require post-processing:



Memory from preceeding meas.



Background subtraction



Off-centre position

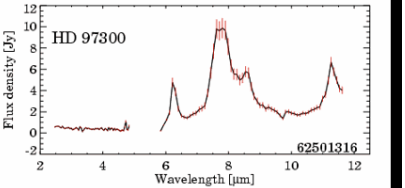
- Corrections can be made with our IDL-based package.
- We check for too low/high detector temperature.
- Empirical photometric correction is applied at the end of the processing scheme.
- Error estimate from an ensemble of 42 normal star observations.

ISOPHOT archive: PHT-S post-processing

ISOPHOT-S Spectrophotometric Atlas of Young Stellar Objects

HD 97300

Type:
Herbig Ae/Be star
Observation:
ISO 62501316
Date 02-Aug-1997
Position (2MASS):
RA(2000): 11 09 50.03
DEC(2000): -76 36 47.7
External links:
Simbad
IRAS 11082-7620
Additional ISO spectra:
07901912 (PHT-S)
14100945 (SWS)

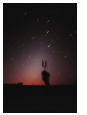


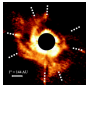
Data Reduction Log:

- Standard processing to AAP with PIA V10.0
- Memory from preceeding observation corrected
- DIRBE-based zodiacal spectrum subtracted
- Position offset (DY=+1.0", DZ=-0.6") corrected
- Empirical photometric correction applied

Infrared science at Konkoly Observatory

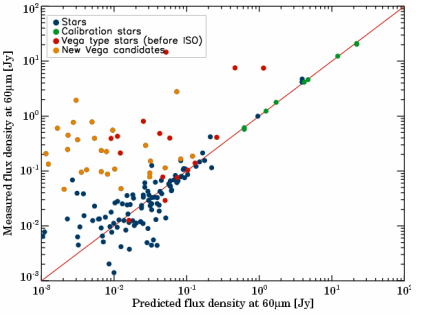
- **Infrared sky background**
  - Zodiacal light
  - Galactic cirrus
  - Extragalactic background
- **Cosmic dust properties**
- **Interstellar clouds, star formation**
- **Disks around young stellar objects**
- **Eruptive young stars**
- **The Vega-phenomenon**

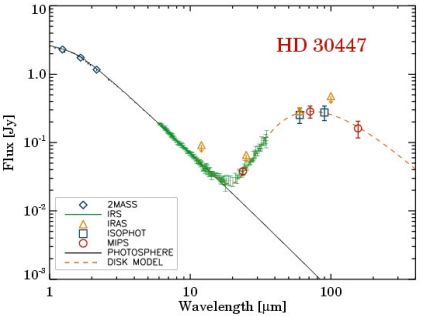



Science highlight: Vega-phenomenon

- Several ISOPHOT key-programmes were devoted to Vega-phen.
- No unified homogeneous catalogue was produced
- We are creating such a catalogue based on mini-map and sparse map observations



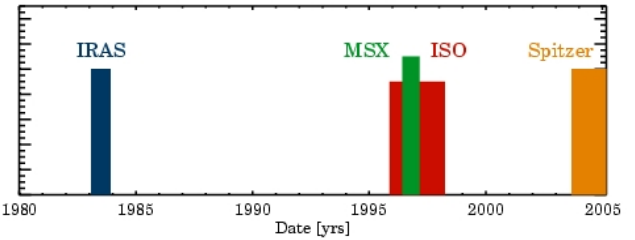


Infrared variability

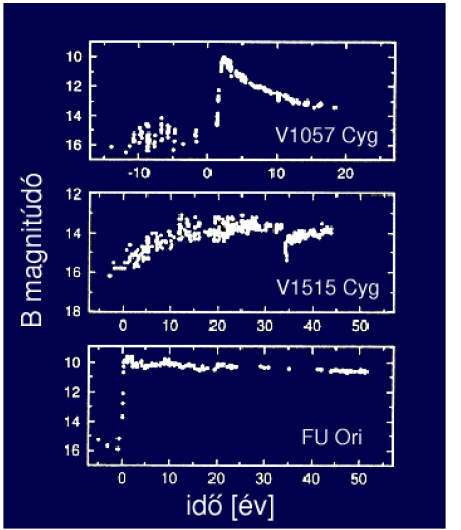
Many different types of objects exhibit light variations in the infrared.

But the variations are difficult to measure…

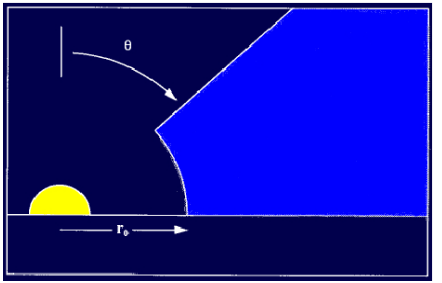
Konkoly Observatory is one of the first places which explore this field

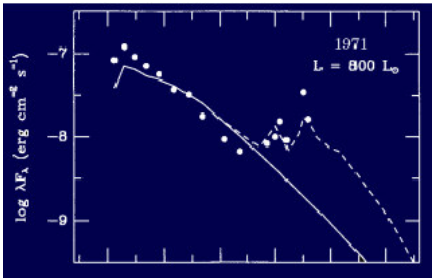


Flux variations of FU Orionis stars

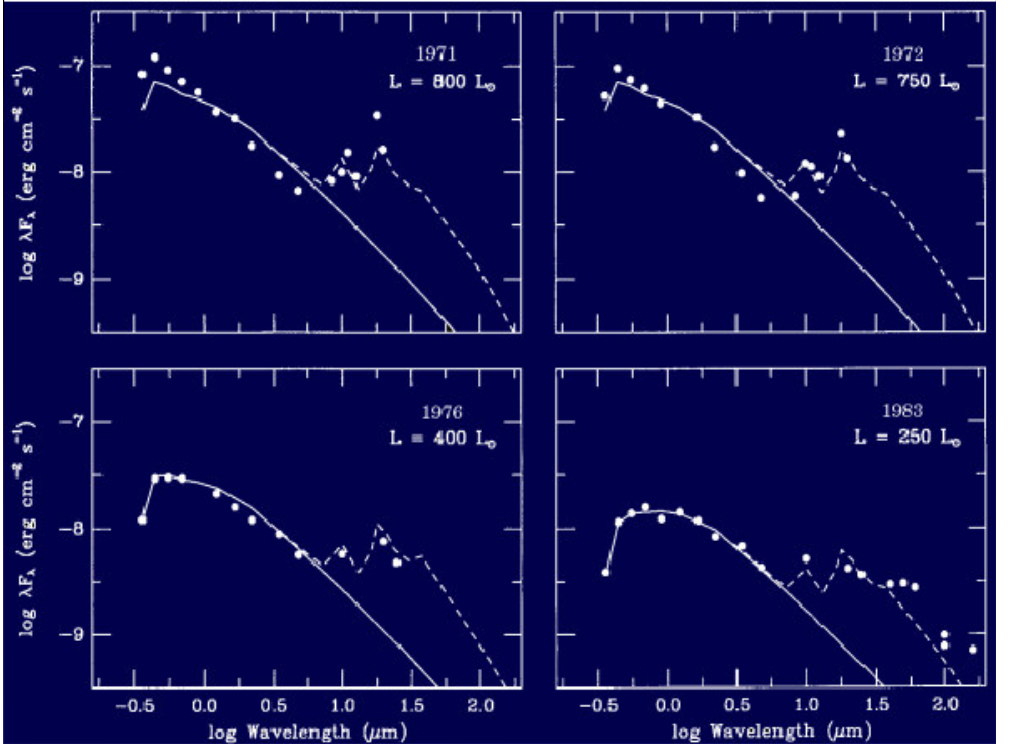


The model of V1057 Cyg: disk + envelope

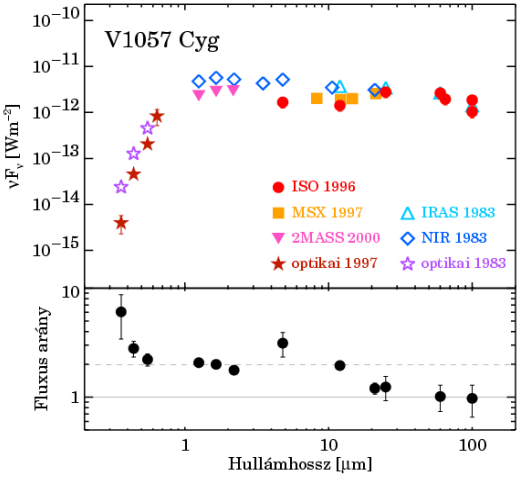




Kenyon & Hartman (1991)


1971
L = 800 L⊙
1972
L = 750 L⊙
1976
L = 400 L⊙
1983
L = 250 L⊙
log λF_λ (erg cm^-2 s^-1)
−7
−8
−9
−0.5
0.0
0.5
1.0
1.5
2.0
log Wavelength (μm)

V1057 Cyg: IRAS + ISOPHOT (1983-1997)



Near- and mid-infrared: fading simultaneously with the star

Far-IR: constant brightness!!!

Possible explanations:

1. Envelope optically thick
2. The disk is active (accretion energy)
3. Extra heating from the environment
4. Infrared companion
5. ?????

KISAG factsheet

Personnel: L.G. Balázs, P. Ábrahám, T. Csengeri (student), Sz. Csizmadia, A. Juhász (student), Cs. Kiss, Á. Kóspál (PhD student), A. Moór, M. Kun, L.V. Tóth, (E. Forgács-Dajka)

Publications: 26 refereed papers, 45 conference proceedings

ISO HPDPs: 7 catalogues (so far), more than 2000 TDTNUMs

Visitors: J. Acosta-Pulido, D. Apai, Bidushi Bhatacharya, C. del Burgo, L. Haikala, U. Klaas, L. Koch-Miramond, R.J. Laureijs, D. Lemke, T. Prusti, G. Stringfellow, R. Tuffs, R. Vavrek, E. Verdugo, F. Zagury

Helpdesk quesions: ~10 requests

Married to ISO forever? Yes and No!

We want to keep ISOPHOT data analysis knowledge alive as long as possible.

In infrared variability studes ISOPHOT data will have their role (e.g. pre-outburst fluxes).

Absolute surface brightness photometry has to be finalized and published.

Large statistical studies / data mining.

Combination of ISOPHOT data with other satellite results (KISAG tradition).

Try to convert experience from ISO to Herschel.


Thank you for
your attention!
KONKOLY INFRARED SPACE
ASTRONOMY GROUP