



# Herschel data-mining tools enabling Herschel-ALMA science



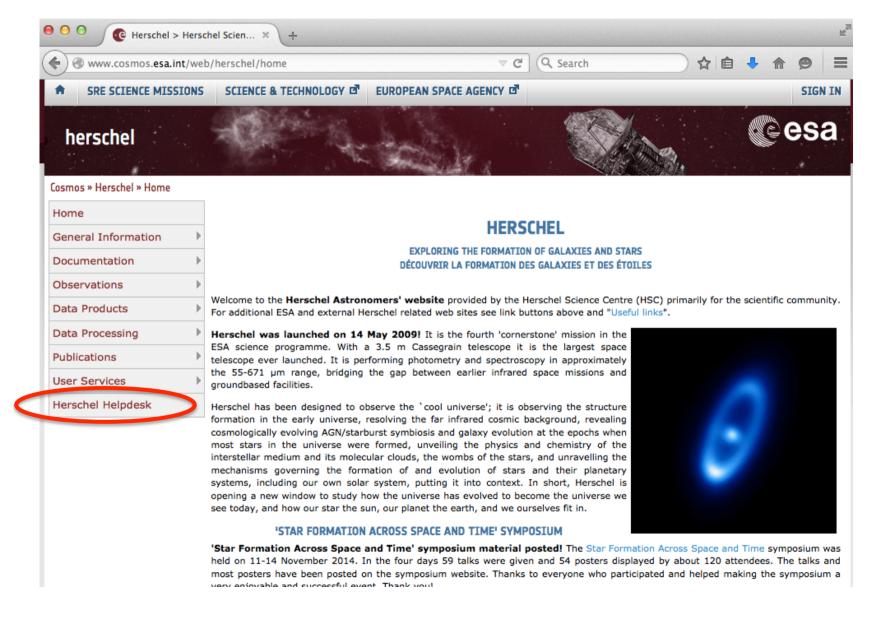
Pedro García-Lario, Head of Herschel Science Centre & Herschel Mission Manager



### **Herschel Science Centre WWW**



http://www.cosmos.esa.int/web/herschel/





### Herschel data mining tools (I)



### ✓ Herschel Science Archive user interface (covered by Eva Verdugo)

http://www.cosmos.esa.int/web/herschel/science-archive

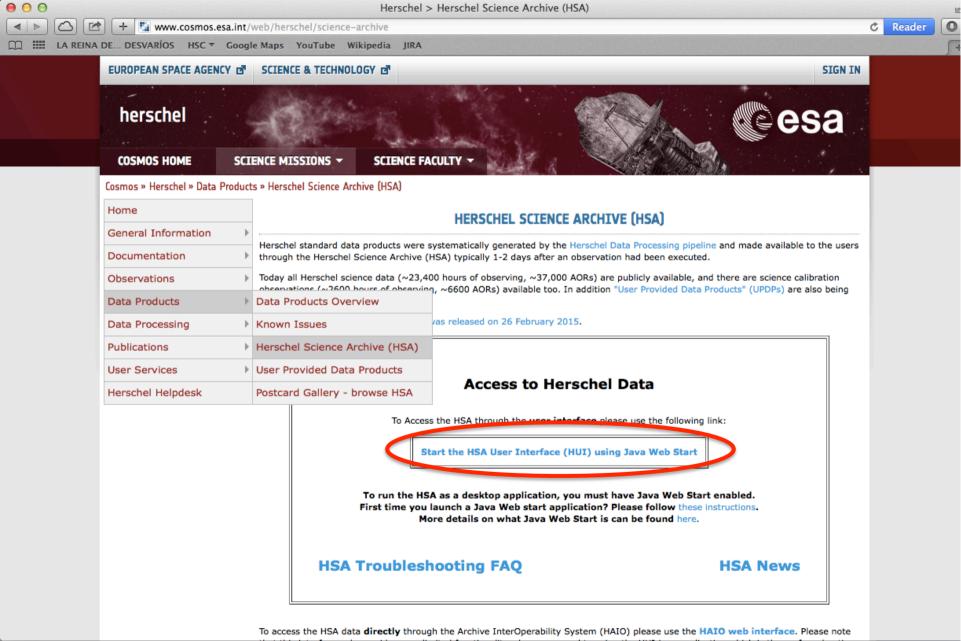
- standard search by coordinates / target name (SIMBAD, NED) / instrument specific parameters, ...
- search by proposal name / proposal PI / OBSID
- search for user provided data products [UPDPs]
- postcard server which provides access to standalone browse products
- all science observations are public since October 2013

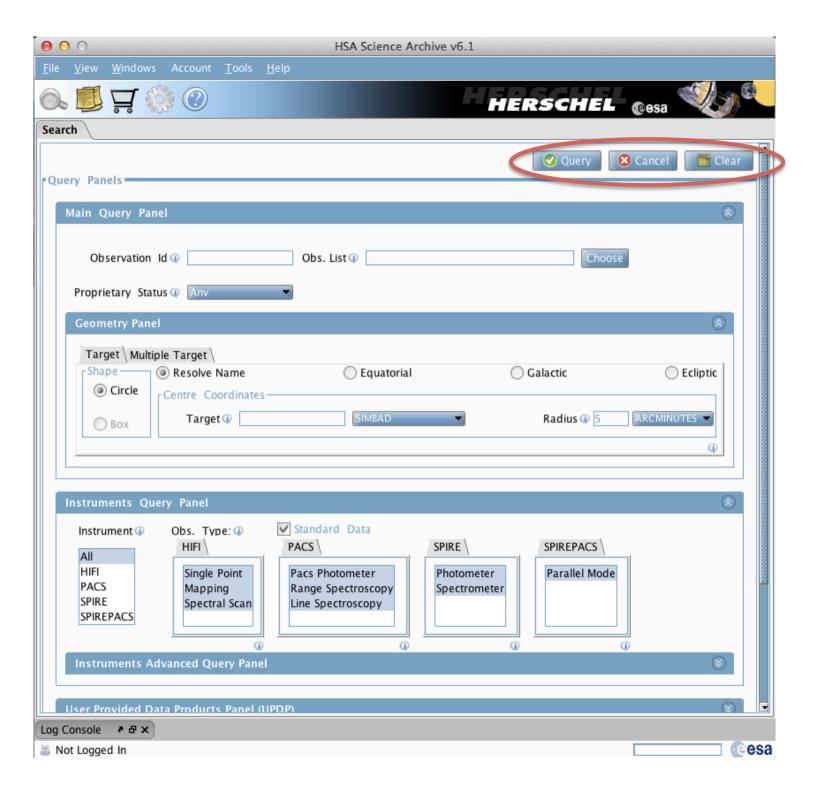
Has my favourite source been observed with Herschel?



# Accessing the HSA User Interface





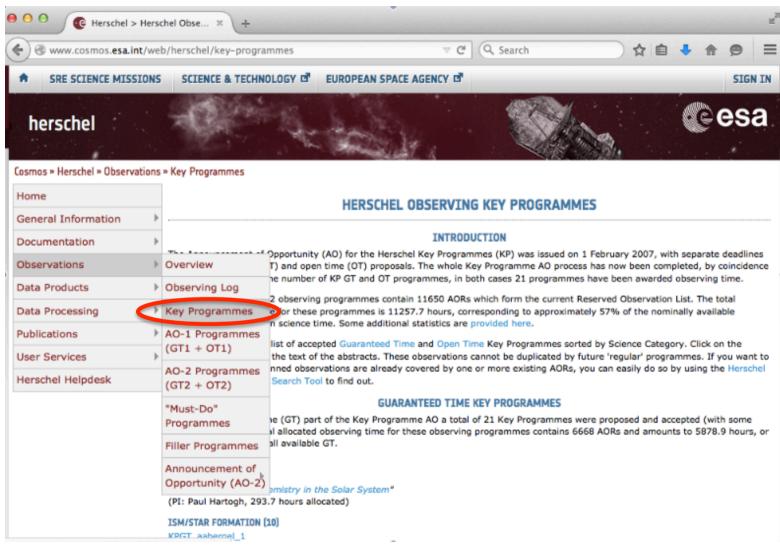






### Herschel science programmes



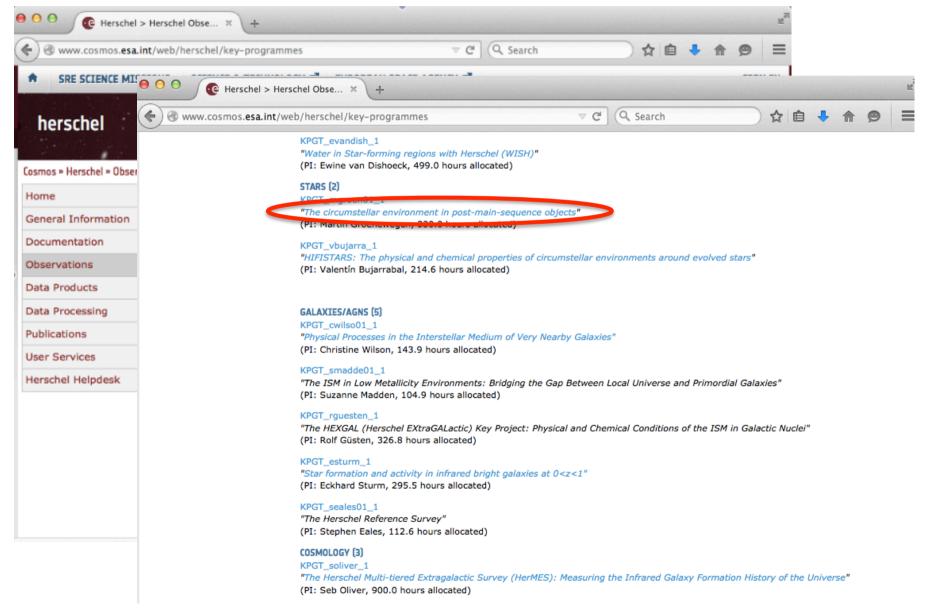


Where can I find a full list of all approved Herschel programmes?



### **Herschel science programmes**

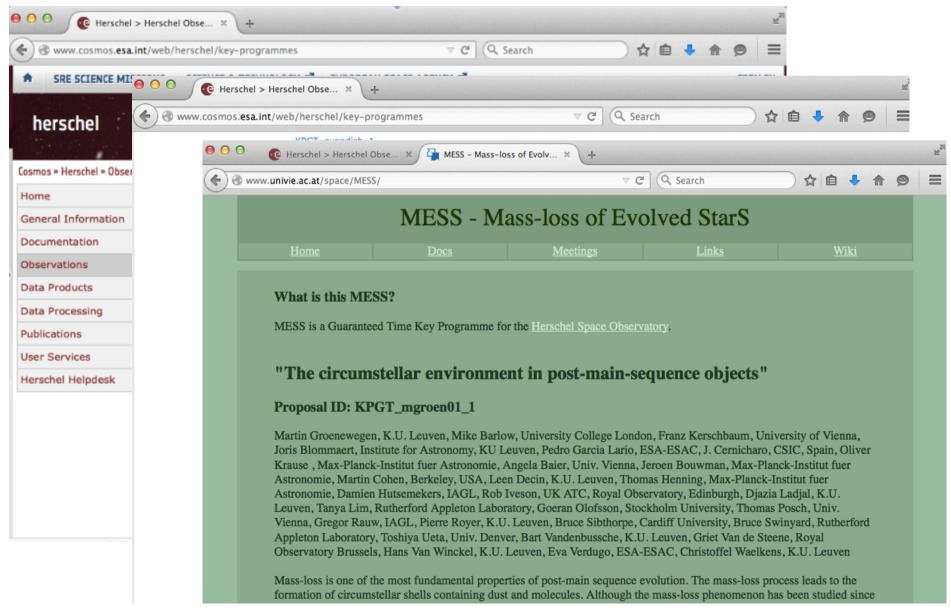






### Herschel science programmes







### Herschel data mining tools (II)



### ✓ Herschel Observing Log

http://herschel.esac.esa.int/logrepgen/observationlist.do

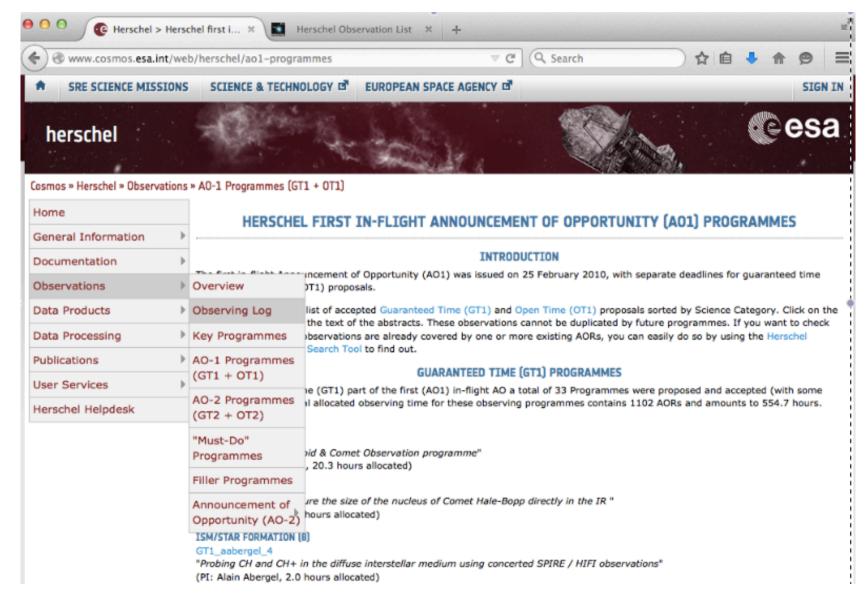
 useful for other searches (e.g. by science category), which are not (yet) possible in HSA

Has my favourite science topic been covered by any Herschel observing programme?



### **Herschel Observing Log**







# **Observing Log**

Query	0	b٤	se	rv	at	io	r	IS
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OD From:		OD To:		
Target		Proposal		
AOT	HifiSpectralScan HifiMapping HifiPoint PacsLineSpec	Subinstrument	P_SPEC P_PHOT S_SPEC S_PHOT	
Obs. Id		AOR label		
Duration (min):		Duration (max):		
Start Time From:	(e.g. 2010-09-05T16:30:00Z)	Start Time To:		(e.g. 2010-09-05T16:30:00Z)
SPG version		QC State		
Science Category	Active galaxies/ULGs/QSOs Asteroids Brown Dwarfs/Very Low-Mass St Circumstellar/Debris disks	NAIF Id		
Search observation	s Clear	Observations per page:	: 50 ‡	

38,208 items for nd, displaying 1 to 50. [First/Prev] 1, 2, 3, 4, 5, 6, 7, 8 [Next/Last]

0	Target	RA	DEC	Proposal	AOT	Duration		Obs. Id		SPG version	QC State
14	6 OH	18h52m22.190s	-0d14m13.90s	DDT_kjusttan_3	HifiPoint	1487	2013-04-29T07:40:58Z	1342271266		SPG v12.1.0	PASSED
	32.8-0.3								oh32		
14	6 IRAS	18h51m26.210s	-1d03m51.80s	DDT_kjusttan_3	HifiPoint	1487	2013-04-29T07:14:24Z	1342271265		SPG v12.1.0	PASSED
	18488-010	7							IRAS18488		
14	6 OH	18h48m41.910s	-2d50m28.30s	DDT_kjusttan_3	HifiPoint	1487	2013-04-29T06:47:50Z	1342271264	HStars-Set08 -	SPG v12.1.0	PASSED
	30.1-0.7								OH30.1		
14	6 OH	18h45m53.090s	-1d46m48.00s	DDT_kjusttan_3	HifiPoint	1487	2013-04-29T06:21:16Z	1342271263	HStars-Set08 -	SPG v12.1.0	PASSED
	30.7+0.4								oh30.7		
14	6 irc+10216	9h47m57.410s	+13d16m43.60s	DDT_jcernich_10	HifiPoint	262	2013-04-29T05:53:28Z	1342271262	TV_HNC_12U-	SPG v12.1.0	PASSED
									epoch_4		
14	6 irc+10216	9h47m57.410s	+13d16m43.60s	DDT icernich 10	HifiPoint	286	2013-04-29T05:46:55Z	1342271261	TV HNC 12L-	SPG v12.1.0	PASSED



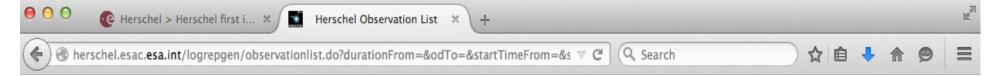
# **Observing Log**

Quer	y obse	rvations
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OD From:			OD To:		
Target			Proposal		
AOT	HifiSpectralScan HifiMapping HifiPoint PacsLineSpec		Subinstrument	P_SPEC P_PHOT S_SPEC S_PHOT	
Obs. Id			AOR label		
Duration (min):			Duration (max):		
Start Time From:		(e.g. 2010-09-05T16:30:00Z)	Start Time To:		(e.g. 2010-09-05T16:30:00Z)
SPG version			QC State		
Science Category	Low-z galaxies Nearby galaxies Planets Satellites		NAIF Id		
Search observation	ns Clear		Observations per page	: 50 ‡	

38.208 items found, displaying 1 to 50, [First/Prev] 1, 2, 3, 4, 5, 6, 7, 8 [Next/Last]

_		ma, aropia, mg						_	_		
OD	Target	RA	DEC	Proposal	AOT	Duration	Start time	Obs. Id	AOR Label	SPG version	
	32.8-0.3	18h52m22.190s		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	HifiPoint		2013-04-29T07:40:58Z		oh32	SPG v12.1.0	
	IRAS 18488-0107	18h51m26.210s	-1d03m51.80s	DDT_kjusttan_3	HifiPoint	1487	2013-04-29T07:14:24Z		HStars-Set08 - IRAS18488	SPG v12.1.0	PASSED
1446	OH 30.1-0.7	18h48m41.910s	-2d50m28.30s	DDT_kjusttan_3	HifiPoint	1487	2013-04-29T06:47:50Z		HStars-Set08 - OH30.1	SPG v12.1.0	PASSED
1446	OH 30.7+0.4	18h45m53.090s	-1d46m48.00s	DDT_kjusttan_3	HifiPoint		2013-04-29T06:21:16Z		oh30.7	SPG v12.1.0	
1446	irc+10216	9h47m57.410s	+13d16m43.60s	DDT_jcernich_10	HifiPoint	262	2013-04-29T05:53:28Z		TV_HNC_12U- epoch_4	SPG v12.1.0	PASSED



# **Observing Log**

A		m rodl a ma
Query	obse	rvations

OD From:			OD To:		
Target			Proposal		
AOT	HifiSpectralScan HifiMapping HifiPoint PacsLineSpec		Subinstrument	P_SPEC P_PHOT S_SPEC S_PHOT	
Obs. Id			AOR label		
Duration (min):			Duration (max):		
Start Time From:		(e.g. 2010-09-05T16:30:00Z)	Start Time To:		(e.g. 2010-09-05T16:30:00Z)
SPG version			QC State		
Science Category	Kuiper Belt bodies Local Group galaxies Low-z galaxies Nearby galaxies		NAIF Id		
Search observation			Observations per page:	50 ‡	

3,327 items found, a splaying 51 to 100. [First/Prev] 1, 2, 3, 4, 5, 6, 7, 8 [Next/Last]

	OD	rarget	RA	DEC	Proposal	AOT	Duration	Start time	Obs. Id	AOR Label	SPG version	QC State
	1441	UGC 04256	8h10m15.180s	+33d57m23.90s	OT2_kwestfal_2	PacsPhoto	718	2013-04-24T02:40:31Z		PPhoto-070-050 - UGC 04256	SPG v12.1.0	PASSED
	1441	UGC 04622	8h50m20.180s	+41d17m21.90s	OT2_kwestfal_2	PacsPhoto	718	2013-04-24T03:07:43Z		PPhoto-100-040 - UGC 04622	SPG v12.1.0	PASSED
	1441	UGC 04622	8h50m20.180s	+41d17m21.90s	OT2_kwestfal_2	PacsPhoto	718	2013-04-24T03:20:47Z		PPhoto-100-130 - UGC 04622	SPG v12.1.0	PASSED
	1441	UGC 04622	8h50m20.180s	+41d17m21.90s	OT2_kwestfal_2	PacsPhoto	718	2013-04-24T03:33:51Z		PPhoto-070-140 - UGC 04622	SPG v12.1.0	PASSED
•	1441	UGC 04622	8h50m20.180s	+41d17m21.90s	OT2_kwestfal_2	PacsPhoto	718	2013-04-24T03:46:55Z		PPhoto-070-050 - UGC 04622	SPG v12.1.0	PASSED
•	1441	UGC 04555	8h44m08.270s	+34d43m02.10s	OT2 kwestfal 2	PacsPhoto	718	2013-04-24T04:15:05Z	1342270852	PPhoto-100-040 - UGC	SPG v12.1.0	PASSED



## Herschel data mining tools (III)



### ✓ Herschel catalogues in VizieR

http://vizier.u-strasbg.fr/viz-bin/VizieR

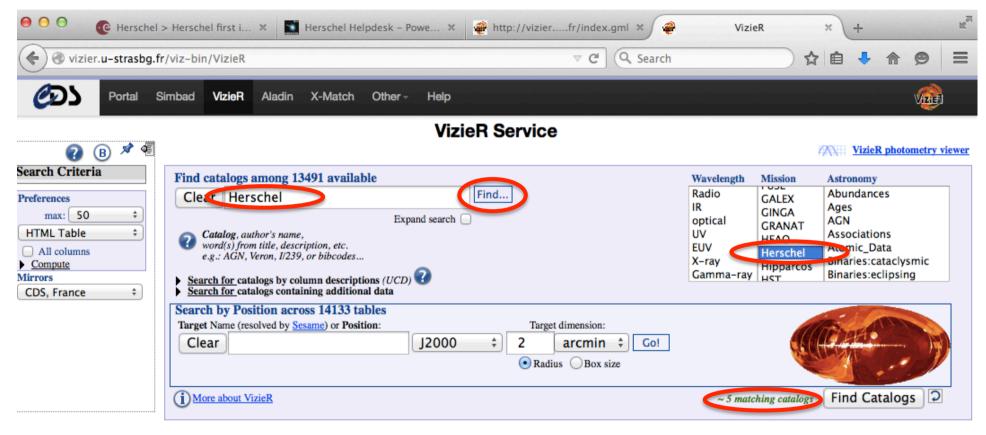
- search for added value products e.g. photometric fluxes, SEDs,...
- currently, more than 67 catalogues containing hundred thousands entries, including the Herschel Observing Log (VI/139), with links to postcards and associated standalone browse products
- more are coming... (see talks later in this workshop)

What kind of added value information is available on my favourite astronomical source provided by Herschel?



### Herschel catalogues in VizieR





new Go to the VizieR main page for documentations or other browse modes

#### Tools related to VizieR

- Photometry viewer: Plot photometry (sed) including all VizieR
- TAP VizieR: query VizieR using ADQL (a SQL extension dedicated for astronomy)
- CDS cross-match service: fast cross-identification between any 2 tables, including VizieR catalogues, SIMBAD



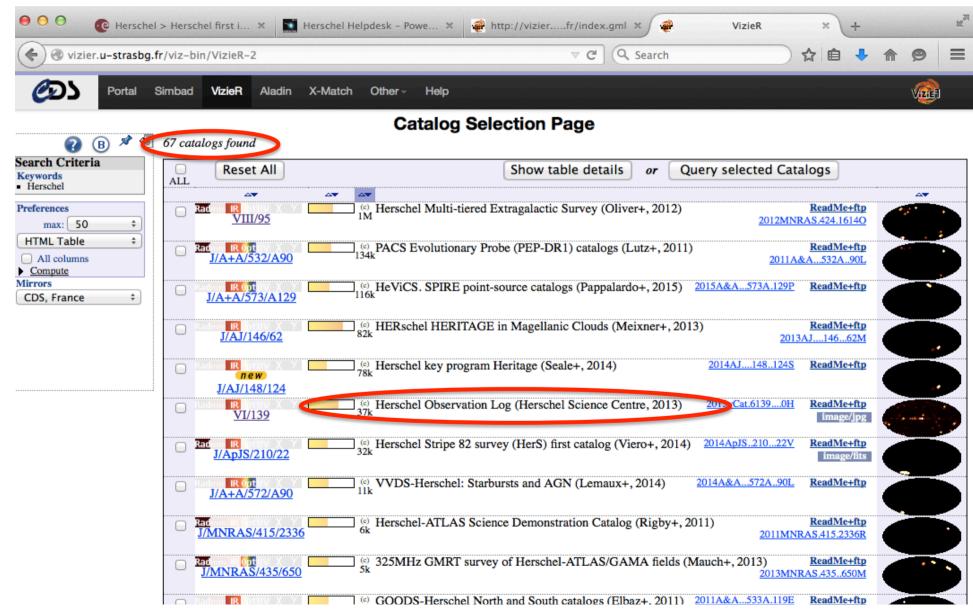
<sup>→</sup> Thanks for acknowledging the VizieR Service

<sup>→</sup> Rules of usage of VizieR data



### Herschel catalogues in VizieR

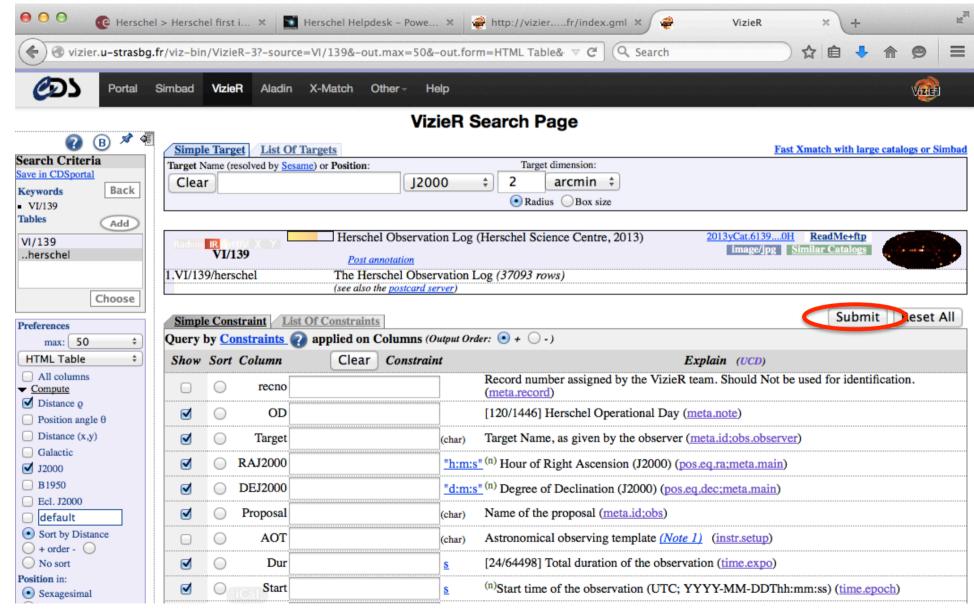






# **Access to Herschel Observing Log in VizieR**

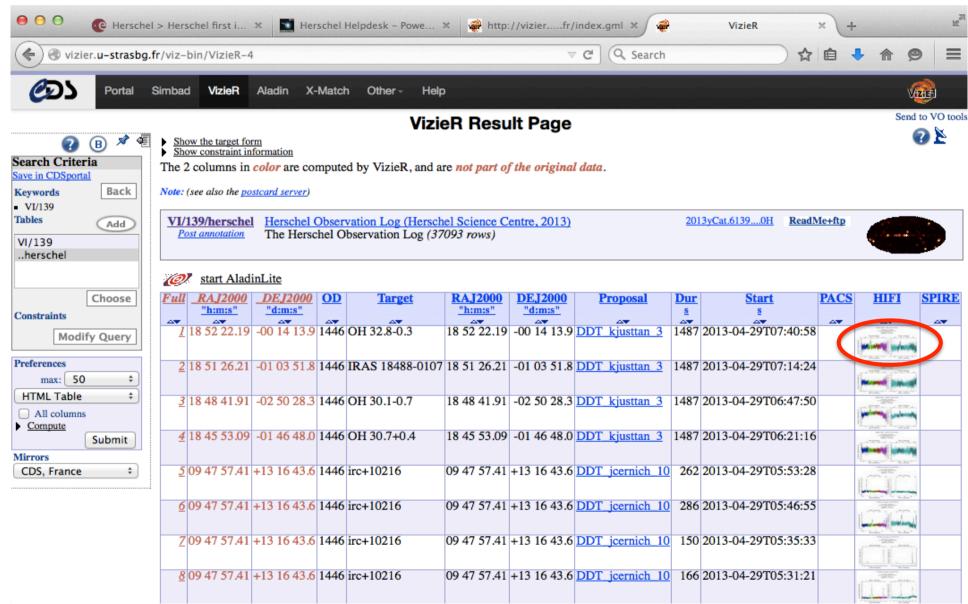






### **Access to Herschel data from VizieR**

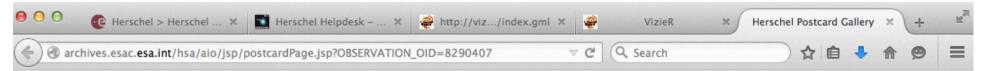






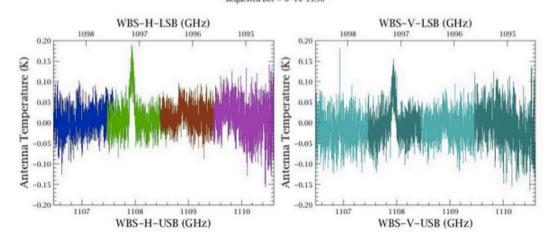
### **Access to Herschel data from VizieR**





#### HStars-Set08 - oh32 (1342271266)

Observing Mode = DBS fastChop Spectrometer = HRS-H HRS-V WBS-H WBS-V Source = OH 32.8-0.3 Requested RA = 18h 52m 22.19s Requested Dec = 0° 14' 13.90°



Observation:	1342271266
Instrument:	HIFI
Mode:	HifiPointModeDBS
Target:	OH 32.8-0.3
RA:	18h52m22s
DEC:	-0d14m14s
OD Number:	1446
Duration:	1533s
Proposal Id:	DDT_kjusttan_3
Data	Download



### Herschel data mining tools (IV)



### ✓ Herschel Publications Tool

http://herschel.esac.esa.int/hpt

- search for science results derived from Herschel observations
- only refereed papers
- query by author, journal, affiliation, science area, abstract keywords,...
- with links to full text through ADS and standalone browse products through linked postcards

Has this particular Herschel observation / science programme resulted in a refereed publication?

What are the existing refereed publications covering my favourite target / science topic?

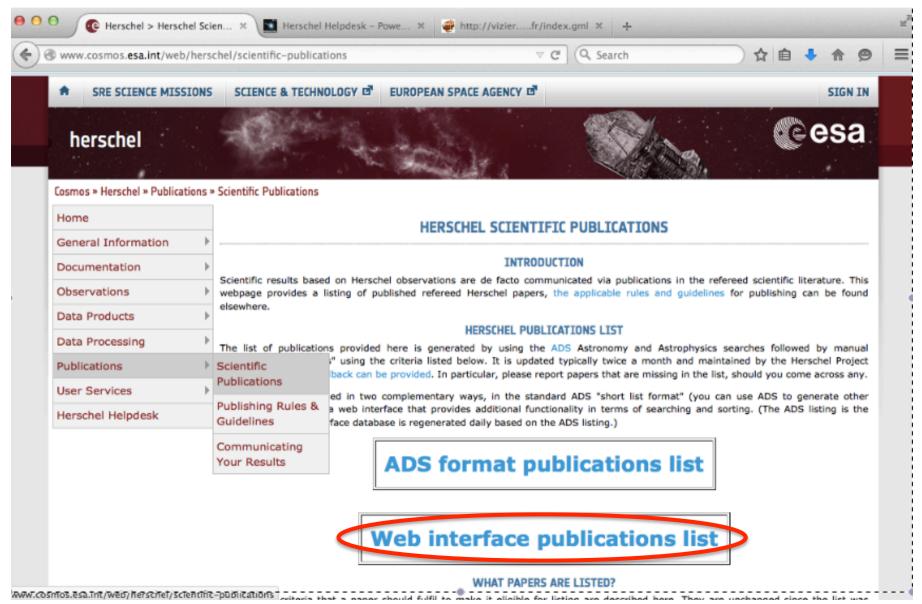
Give me all refereed publications in which Joe Astronomer is co-author



### **Herschel scientific publications**



http://www.cosmos.esa.int/web/herschel/scientific-publications











### **Publication List**

Last update: 2015.04.13 T 09:37:02 CEST

▼ Filter

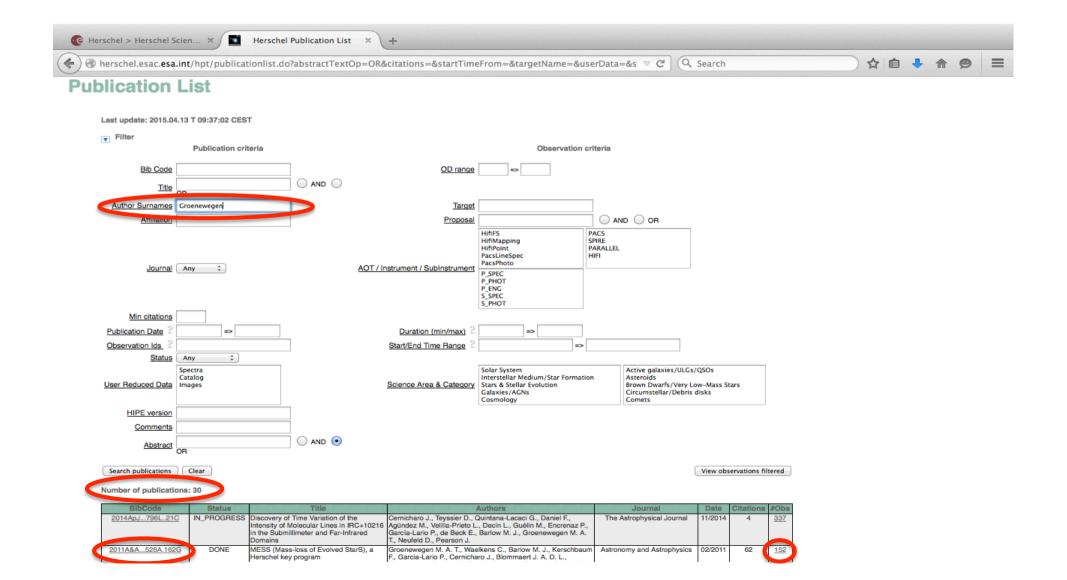
Number of publications: 1363

BibCode	Status	Title	Authors	Journal	Date	Citations	#Obs
2015Natur.519436T	DONE	Wind from the black-hole accretion disk driving a molecular outflow in an active galaxy	Tombesi F., Meléndez M., Veilleux S., Reeves J. N., González-Alfonso E., Reynolds C. S.	Nature	03/2015	2	1
2015MNRAS.449L82G	DONE		Greaves J. S., Whitelaw A. C. M., Bendo G. J.	Monthly Notices of the Royal Astronomical Society	04/2015	0	9
2015MNRAS.449.2498I		H-ATLAS/GAMA galaxies out to z = 0.2	lbar E., Lara-López M. A., Herrera-Camus R., Hopwood R., Bauer A., Ivison R. J., Michałowski M. J., Dannerbauer H., van der Werf P., Riechers D., Bourne N., Baes M., Valtchanov I., Dunne L., Verma A., Brough S., Cooray A., De Zotti G., Dye S., Eales S., Furlanetto C., Maddox S., Smith M., Steele O., Thomas D., Valiante E.	Monthly Notices of the Royal Astronomical Society	05/2015	0	0
2015MNRAS.449.2274H	DONE	of the Herschel SPIRE Fourier Transform Spectrometer	Hopwood R., Polehampton E. T., Valtchanov I., Swinyard B. M., Fulton T., Lu N., Marchili N., van der Wiel M. H. D., Benielli D., Imhof P., Baluteau JP., Pearson C., Clements D. L., Griffin M. J., Lim T. L., Makiwa G., Naylor D. A., Noble G., Puga E., Spencer L. D.	Monthly Notices of the Royal Astronomical Society	05/2015	0	423
2015MNRAS.449.1309G	DONE	Seyfert galaxy NGC 2992 and the interacting system Arp 245	García-Bernete I., Ramos Almeida C., Acosta-Pulido J. A., Alonso-Herrero A., Sánchez-Portal M., Castillo M., Pereira- Santaella M., Esquej P., González- Martín O., Díaz-Santos T., Roche P., Fisher S., Pović M., Pérez García A. M., Valtchanov I., Packham C., Levenson N. A.	Monthly Notices of the Royal Astronomical Society	05/2015	0	5]



http://www.herschel.esac.esa.int/hpt

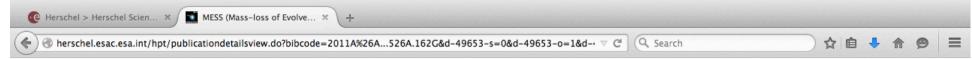












#### **Publication details**

#### MESS (Mass-loss of Evolved StarS), a Herschel key program

Groenewegen M. A. T., Waelkens C., Barlow M. J., Kerschbaum F., Garcia-Lario P., Cernicharo J., Blommaert J. A. D. L., Bouwman J., Cohen M., Cox N., Decin L., Exter K., Gear W. K., Gomez H. L., Hargrave P. C., Henning T., Hutsemékers D., Ivison R. J., Jorissen A., Krause O., Ladjal D., Leeks S. J., Lim T. L., Matsuura M., Nazé Y., Olofsson G., Ottensamer R., Polehampton E., Posch T., Rauw G., Royer P., Sibthorpe B., Swinyard B. M., Ueta T., Vamvatira-Nakou C., Vandenbussche B., van de Steene G. C., van Eck S., van Hoof P. A. M., van Winckel H., Verdugo E., Wesson R.

#### Journal

Astronomy and Astrophysics 526 AA162-

#### Abstract

MESS (Mass-loss of Evolved StarS) is a guaranteed time key program that uses the PACS and SPIRE instruments on board the Herschel space observatory to observe a representative sample of evolved stars, that include asymptotic giant branch (AGB) and post-AGB stars, planetary nebulae and red supergiants, as well as luminous blue variables, Wolf-Rayet stars and supernova remnants. In total, of order 150 objects are observed in imaging and about 50 objects in spectroscopy. This paper describes the target selection and target list, and the observing strategy. Key science projects are described, and illustrated using results obtained during Herschel's science demonstration phase. Aperture photometry is given for the 70 AGB and sub-mm fluxes for late-type stars. Herschel is an ESA space observatory with science instruments provided by European-led Principal Investigator consortia and with important participation from NASA.Appendices and Tables 1 and 2 are only available in electronic form at <a href="https://www.aanda.org">https://www.aanda.org</a>

BibCode: 2011A&A...526A.162G

DOI: 10.1051/0004-6361/201015829

Citations: 62

#### Observations:

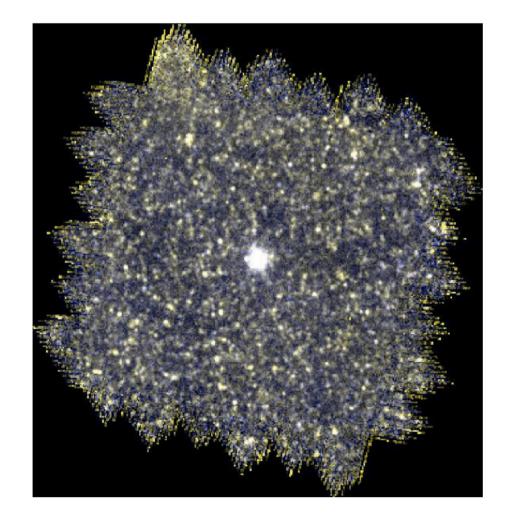
OD	Target	RA	DEC	Proposal	AOT	Duration	Start time	Obs. Id	AOR Label	SPG version	QC State	rostearu
522	CIT 6	10h16m02.270s	+30d34m18.60s	KPGT_mgroen01_1	SpirePhoto	4391	2010-10-17T17:12:29Z	1342206689	SPhoto-0001 - R Dor - CIT 6	SPG v12.1.0	PASSE	
497	S CAS	1h19m41.970s	+72d36m39.30s	KPGT_mgroen01_1	PacsPhoto	519	2010-09-22T22:28:40Z	1342205040	PPhoto- S_CAS_45	SPG v12.1.0	PASSED	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1



http://www.herschel.esac.esa.int/hpt







Observation: 1342206689

Instrument: SPIRE

Mode: SpirePhotoLargeScan

Target: CIT 6

RA: 10h16m02s

DEC: 30d34m10s

OD Number: 522

Duration: 4391s

Proposal Id: KPGT\_mgroen01\_1

Data Download



### Herschel data mining tools (V)



### √ Herschel in ADS (Astrophysics Data System)

http://adsabs.harvard.edu/abstract\_service.html
http://cdsads.u-strasbg.fr/abstract\_service.html

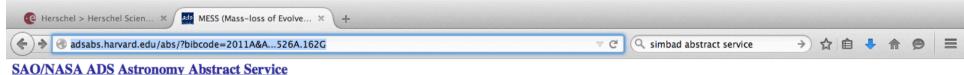
- access to full text of refereed papers / also links to observations used for the paper and associated postcards from 'On-Line Data'
- ADS include links to Herschel proposal abstracts since only a few weeks ago

How to access the full contents of publications based on Herschel data?

Which Herschel observations were used to produce a particular publication?







- · Find Similar Abstracts (with default settings below)
- · Electronic Refereed Journal Article (HTML)
- · Full Refereed Journal Article (PDF/Postscript)
- · 2-Aiv e-print (2rXiv:1012.2701)
- On-line Data
- · References in the article
- · Citations to the Article (63) (Citation History)
- · Refereed Citations to the Article
- · SIMBAD Objects (132)
- · Also-Read Articles (Reads History)
- · Translate This Page

Affiliation:

Title: MESS (Mass-loss of Evolved StarS), a Herschel key program

Authors: Groenewegen, M. A. T.; Waelkens, C.; Barlow, M. J.; Kerschbaum, F.; Garcia-Lario, P.; Cernicharo, J.; Blommaert, J. A. D. L.; Bouwman, J.; Cohen, M.; Cox, N.;

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Lim, T. L.; Matsuura, M.; Nazé, Y.; Olofsson, G.; Ottensamer, R.; Polehampton, E.; Posch, T.; Rauw, G.; Royer, P.; Sibthorpe, B.; Swinyard, B. M.; Ueta, T.; Vamvatira-

Nakou, C.; Vandenbussche, B.; van de Steene, G. C.; van Eck, S.; van Hoof, P. A. M.; van Winckel, H.; Verdugo, E.; Wesson, R.

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Appleton Laboratory, Oxfordshire, OX11 0QX, UK), AW(Space Science and Technology Department, Rutherford Appleton Laboratory, Oxfordshire, OX11 0QX, UK), AX(Department of Physics and Astronomy, University College London, Gower Street, London WC1E 6BT, UK: Mullard Space Science Laboratory, University College







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Astronomy and Astrophysics 526 AA162-

#### Abstract

MESS (Mass-loss of Evolved StarS) is a guaranteed time key program that uses the PACS and SPIRE instruments on board the Herschel space observatory to observe a representative sample of evolved stars, that include asymptotic glant branch (AGB) and post-AGB stars, planetary nebulae and red superglants, as well as luminous blue variables, Wolf-Rayet stars and supernova remnants. In total, of order 150 objects are observed in imaging and about 50 objects in spectroscopy. This paper describes the target selection and target list, and the observing strategy. Key science projects are described, and illustrated using results obtained during Herschel's science demonstration phase. Aperture photometry is given for the 70 AGB and post-AGB stars observed up to October 17, 2010, which constitutes the largest single uniform database of far-IR and sub-mm fluxes for late-type stars. Herschel is an ESA space observatory with science instruments provided by European-led Principal Investigator consortia and with important participation from NASA.Appendices and Tables 1 and 2 are only available in electronic form at <a href="https://www.aanda.org">https://www.aanda.org</a>

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Citations: 6

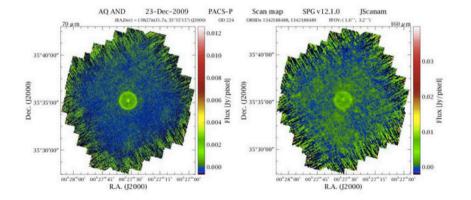
#### Observations:

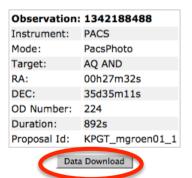
OD	Target	RA	DEC	Proposal	AOT	Duration	Start time	Obs. Id	AOR Label	SPG version	QC State	Postcard
224	AQ AND	0h27m31.680s	+35d35m14.50s	KPGT_mgroen01_1	PacsPhoto	892	2009-12-23T22:41:57Z	1342188488	PPhoto- AQ_AND_45	SPG v12.1.0	PASSED	To have to me to have the control of
224	AQ AND	0h27m31.680s	+35d35m14.50s	KPGT_mgroen01_1	PacsPhoto	892	2009-12-23T22:57:52Z	1342188489	PPhoto- AQ_AND_135	SPG v12.1.0	PASSED	













### Coming soon...



### √ Herschel in SIMBAD/NED

- cross-matches with SIMBAD objects (currently being produced and carefully scrutinized) will also soon allow linking to Herschel observations
- At the moment only a few cross-matched sources have been ingested in SIMBAD – this will be extended to the whole archive

Users will be confronted with Herschel measurements without a priori knowledge of Herschel

### ✓ Herschel in the Virtual Observatory

SPIRE and PACS photometric observations will be the first

Use of Herschel data in combination with data from other VO facilities/ observatories



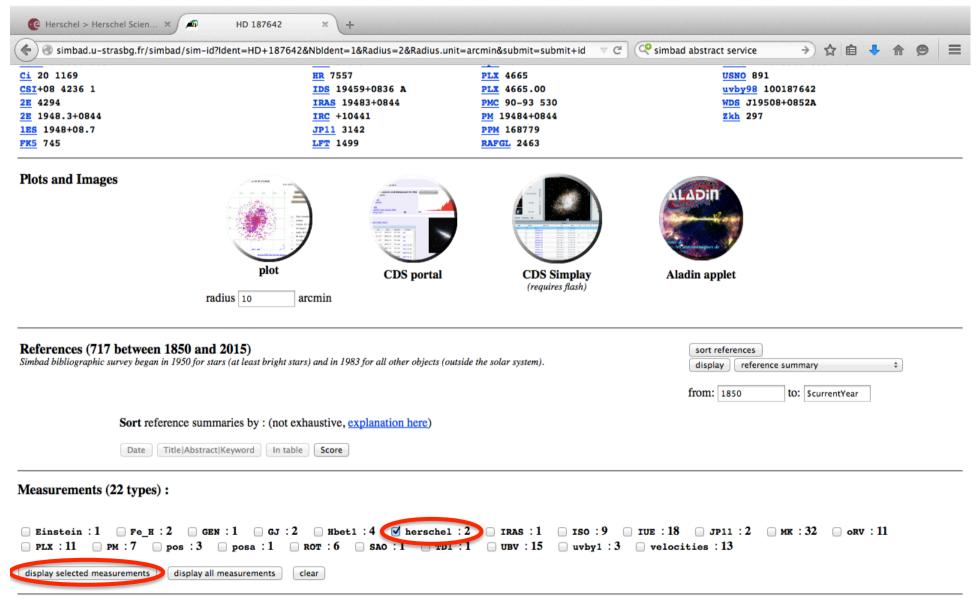




H 0.24 [~] C 2002yCat.2237....OD

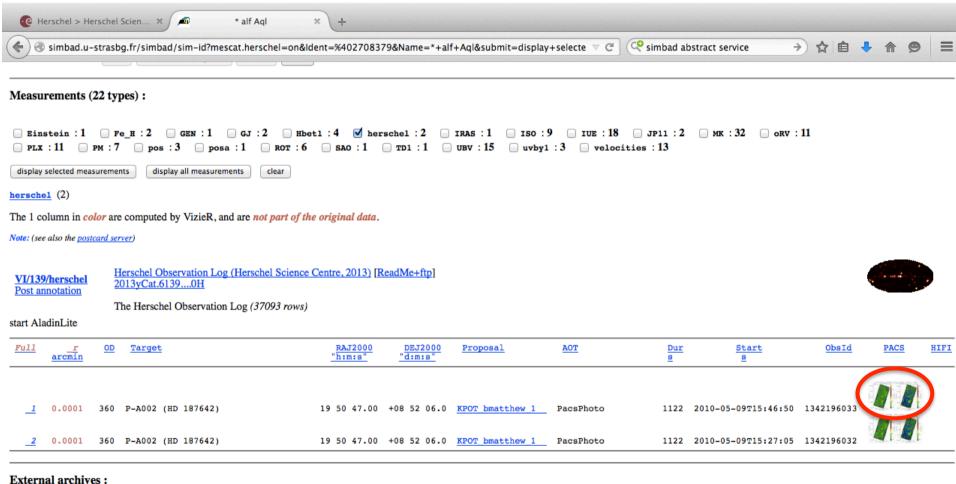












Archive data at HEASARC - High-Energy Astrophysics Science Archive Research Center

Catalogue information from VizieR:

Generic search by coordinates (radius: 14 arcsec)

V\* alf Aql **GJ** 768 HR 7557

AG+08 2636 GSC 01058-03399 IRAS 19483+0844

BD+08 4236 HD 187642 IRC +10441

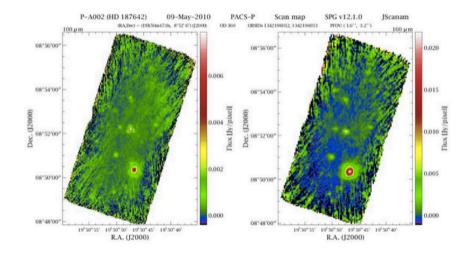
CCDM J19508+0852A HIC 97649 LHS 3490

FK5 745 HIP 97649 LSPM J1950+0852









Observation:	1342196033					
Instrument:	PACS					
Mode:	PacsPhoto					
Target:	P-A002 (HD 187642)					
RA:	19h50m48s					
DEC:	-8d52m13s					
OD Number:	360					
Duration:	1122s					
Proposal Id:	KPOT_bmatthew_1					
Data Download						



# If you want to know more or need help...



✓ Visit the Herschel booth during the coffee breaks during the days of the workshop and ask the experts

**✓** Raise a ticket in our HSC Helpdesk

http://herschel.esac.esa.int/esupport/

Thank you!!