

GOALS: The Great Observatories All-sky LIRG Survey
Second Data Delivery
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science team

1. Introduction

This document describes the second data delivery of the Spitzer Legacy program, GOALS. The Great Observatories All-sky LIRG Survey (GOALS) combines imaging and spectroscopic data from NASA's Spitzer, Hubble, Chandra and GALEX observatories in a comprehensive survey of over 200 of the most luminous infrared-selected galaxies in the local Universe (see <http://goals.ipac.caltech.edu>). An outline of the GOALS project and a multiwavelength analysis of the LIRG VV340, are given in Armus et al. (2009).

This delivery contains imaging (IRAC and MIPS) and spectroscopic (IRS) data for 49 galaxies in the GOALS sample. This document is organized as follows: section 2 lists the data products, their general characteristics and naming convention, sections 3, 4, and 5 provide a description of the post-BCD processing for IRAC, MIPS and IRS data, respectively, and section 6 presents derived data and diagnostic diagrams (e.g. derived fluxes, spatial profiles, etc.) associated with the Spitzer data.

2. Content of the data delivery

The 50 galaxies included in this second delivery were selected from the complete GOALS sample. Table 1 lists the galaxies with images and spectra in this delivery. The following is a list of data products:

- IRAC image mosaics at 3.6, 4.5, 5.6 and 8 μ m. All images are single-extension FITS files. The pixel scale of the mosaics are 0.6 arcsec, and the flux (surface brightness) units are MJy/sr. The mosaics have standard orientation with North up and East to the left.
- MIPS image mosaics at 24, 70, and 160 microns. All images are single-extension FITS files. The pixel scale of the mosaics are wavelength dependent: 1.8 arcsec at 24 μ m, 4.0 arcsec at 70 μ m, and 8.0 arcsec at 160 μ m. The flux (surface brightness) units in all cases are MJy/sr. The mosaics have standard orientation with North up and East to the left.
- IRS nuclear spectra in the Short-Low, Long-Low, Short-High and Long-High modules. IRS spectra are delivered in ASCII (*.tbl) format, similar to those produced by the IRS pipeline. The flux units are Jy. An example spectrum is shown in Figure 1.

- Spatial profiles at two positions along the IRS SL slit, in the 8.6 μm PAH, 10 μm continuum, and 12.8 μm [NeII] fine-structure emission line. Profiles are provided in ASCII format, in units of e^{-1}/sec listed for each spatial pixel. Also included in each file are the profiles at the same three wavelengths for an unresolved standard star. Figure 2 shows an example of the spatial profile at one nod position for the galaxy UGC 3410. The files are structured as follows:
 - Col. 1: Spatial pixel
 - Col. 2: Median flux per pixel at 12.8 μm for SL 1st order, nod 1
 - Col. 3: Same as col. 2, but for the calibration star
 - Col. 4: Median flux per pixel at 10 μm for SL 1st order, nod 1
 - Col. 5: Same as col. 4, but for the calibration star
 - Col. 6: Median flux per pixel at 8.6 μm for SL 1st order, nod 1
 - Col. 7: Same as col. 6, but for the calibration star
 - Col. 8-13: Identical to col. 2-7 but for SL 1st order, 2nd nod position

2.1 File Naming Convention

For each galaxy, the delivered Spitzer data have the following filename conventions:

- **IRAC mosaics:** NAME_irc_chN.fits, where NAME is the object name and N is the channel number (1 = 3.6 μm , 2 = 4.5 μm , 3 = 5.8 μm , and 4 = 8 μm)
- **MIPS mosaics:** NAME_mips_chN.fits, where NAME is the object name and N is the channel number (1 = 24 μm , 2 = 70 μm , and 3 = 160 μm)
- **IRS spectra:** NAME_chN.tbl, where NAME is the object name and N is the channel number (0 = SL, 1 = SH, 2 = LL, 3 = LH)
- **IRS spatial profiles:** NAME_SP.dat_dr1, where NAME is the object name, SP indicates it is a spatial profile, and _dr1 stands for delivery 1.

Table 1: GOALS Sources in delivery #2

Galaxy	Log L_{IR}	RA (J2000)	DEC (J2000)
NGC0023	11.05	00h09m53.41s	+25d55m25.6s
NGC0232	11.3	00h42m45.82s	-23d33m40.9s
MCG+12-02-001	11.44	00h54m03.61s	+73d05m11.8s
ESO244-G012	11.39	01h18m08.10s	-44d27m51.0s
UGC01385	10.99	01h54m53.79s	+36d55m04.6s
NGC0838	11.0	02h09m38.56s	-10d08m49.1s
IC0214	11.37	02h14m05.59s	+05d10m23.7s
ESO420-G013	11.02	04h13m49.69s	-32d00m25.1s
NGC1797	11.0	05h07m44.05s	-08d01m07.2s
IRASF05189-2524	12.11	05h21m01.47s	-25d21m45.4s
UGC03410	11.04	06h14m29.63s	+80d26m59.6s

NGC2146	11.07	06h18m37.71s	+78d21m25.3s
NGC2623	11.54	08h38m24.08s	+25d45m16.9s
IRASF08572+3915	12.1	09h00m25.39s	+39d03m54.4s
IRAS09022-3615	12.26	09h04m12.70s	-36d27m01.1s
UGC05101	11.95	09h35m51.65s	+61d21m11.3s
IRASF10565+2448	12.02	10h59m18.14s	+24d32m34.3s
ESO319-G022	11.04	11h27m54.08s	-41d36m52.4s
ESO440-IG058	11.36	12h06m51.90s	-31d56m54.0s
IRASF12112+0305	12.28	12h13m46.00s	+02d48m38.0s
NGC4194	11.06	12h14m09.61s	+54d31m35.9s
Mrk231	12.51	12h56m14.23s	+56d52m25.2s
NGC5010	10.87	13h12m26.35s	-15d47m52.3s
IRAS13120-5453	12.26	13h15m06.35s	-55d09m22.7s
ESO173-G015	11.34	13h27m23.78s	-57d29m22.2
Mrk273	12.14	13h44m42.11s	+55d53m12.7s
IRASF14348-1447	12.3	14h37m38.37s	-15d00m22.8s
IRASF14378-3651	12.15	14h40m59.01s	-37d04m32.0s
NGC5734	11.06	14h45m09.05s	-20d52m13.7s
IRASF15250+3608	12.02	15h26m59.40s	+35d58m37.5s
Arp220	12.21	15h34m57.11s	+23d30m11.5s
NGC6090	11.51	16h11m40.70s	+52d27m24.0s
NGC6156	11.07	16h34m52.55s	-60d37m07.7s
ESO453-G005	11.29	16h47m31.06s	-29d21m21.6s
IRASF17132+5313	11.89	17h14m20.00s	+53d10m30.0s
CGCG141-034	11.13	17h56m56.63s	+24d01m01.6s
IRAS17578-0400	11.35	18h00m31.90s	-04d00m53.3s
IRASF19297-0406	12.37	19h32m21.25s	-03d59m56.3s
MCG+04-48-002	11.06	20h28m35.06s	+25d44m00.0s
ESO286-IG019	12.0	20h58m26.79s	-42d39m00.3s
ESO467-G027	11.02	22h14m39.92s	-27d27m50.3s
UGC12150	11.29	22h41m12.26s	+34d14m57.0s
IRASF22491-1808	12.11	22h51m49.26s	-17d52m23.5s
ESO148-IG002	12.0	23h15m46.78s	-59d03m15.6s
IC5298	11.54	23h16m00.7s	+25d33m24.1s
NGC7591	11.05	23h18m16.28s	+06d35m08.9s
NGC7679	11.05	23h28m46.66s	+03d30m41.1s
IRASF23365+3604	12.13	23h39m01.27s	+36d21m08.7s
NGC7771	11.34	23h51m24.88s	+20d06m42.6s

Table 1. GOALS sources included in this delivery: Object name is given in Col.1, infrared luminosity ($\log L_{\text{IR}}$ in units of L_{\odot}) is given in Col.2, and RA and DEC (J2000) are given in Cols. 3 & 4, respectively. Note, that L_{IR} is only listed for the first galaxy in multiple-galaxy systems, since this is measured for the entire system.

3. IRAC Data Processing

Initial steps of the IRAC data reduction were provided by Version S11 of the Spitzer Science Center (SSC) pipeline. Further processing was performed using a combination of IDL and IRAF routines. Detector artifacts in the IRAC data include “banding,” “muxbleed,” and “column pulldown,” as described in the IRAC Data Handbook (2006). Several steps were taken to improve upon the Basic Calibrated Data (BCD) from the SSC pipeline. First, instrumental artifacts were removed. The 3.6 and 4.5 μm images suffer from muxbleed and pulldown affecting the rows and columns (respectively) that contain cosmic ray hits, bright stars, or bright galactic nuclei. The 5.8 and 8.0 μm images often have banding artifacts extending along the rows containing galactic nuclei or other bright features. IDL routines developed by the IRAC Instrument Support Team were used to correct all three types of artifact. However, residuals from these correction techniques remain in the final images, especially residual banding at 8 μm . The first frame of the 5.8 μm data was always excluded due to excessively high background levels compared to the other frames. For each field containing the target galaxy or interacting system, individual BCD images were spatially aligned, resampled, and combined into a mosaic image. The SSC Post-BCD software package MOPEX was used for the alignment and resampling, and to mask out known bad pixels in each band. The IRAF module imcombine was used to make mosaics using the images output by MOPEX. Cosmic ray artifacts were removed by sigma-clipping when the mosaics were constructed. In some cases, most often in the 5.8 μm mosaics, background mismatches between BCD images were corrected using the overlap script within the MOPEX package. Although overlap effectively removes background variations between adjacent images, large-scale gradients over a mosaic are preserved. The overlap routine also provides an alternative means of cosmic ray removal.

Due to the presence of bright galactic nuclei, we utilized the high dynamic range (HDR) mode in all four bands. The HDR frames are comprised of 1-2 sec exposures (“short” integration) to calibrate pixels that would have saturated in the 30-second exposures (“long” integrations). Data presented here are mosaics of the long integrations where such mosaics are not saturated. In the event of saturation (very rare for ch1-3, common for ch4), short exposure mosaics are used instead. The EXPTIME header keyword indicates which type of mosaic has been provided.

For each mosaic, the background level has been measured and subtracted from the image. This value is recorded in the BACKGROU header keyword.

3.1 Notes on Individual Objects

The IRAC channel 3 (5.8 μm) mosaic of ESO420-G013 suffers from extreme cosmic ray contamination due to the solar storm of mid-January 2005, and is not included in the GOALS delivery.

4. MIPS Data Processing

4.1. The 24 μm Si:As Detector Array

The BCD pipeline products from the 24 μm channel of MIPS contain some artifacts, mostly due to very bright flux densities, for many of the sources in our program (see Table 2). Notable features in the Si:As (IBC) array data are bright latent image spots trailing along the in-scan direction from bright sources (very rare), and in some cases dark latents (1-2% depressions in responsivity) for sources brighter than about 18 Jy. Residual gradients in the background from the pipeline flat-fielding process are also present at the 1-2% level in many of the 24 μm images. A weak “jail-bars” effect is often present in the BCDs, reflecting different readout gains rather than saturation. Another potential problem is optical distortion at 24 μm , which can induce photometric calibration variations of 2-10% across the array in some frames; the post-BCD pipeline reductions correct for this particular problem using MOPEX. More detailed descriptions and illustrations of these instrumental effects are given in the MIPS Data Handbook (2006). Where possible, the self-calibration procedure (self-cal) was used to remove latents and weak jailbars. However, often the small number of input images (14, for the most common AOR) precluded self-calibration. The overlap routine discussed in §3, which is part of the MOPEX package, was used in the initial stages of mosaic creation at 24 μm . The final mosaics, after treatment for saturation effects where present (§§4.3), were constructed using the mosaic routine of MOPEX.

4.2. The 70 and 160 μm Ge:Ga Detector Arrays

MOPEX was used to resample and align the MIPS BCD images and combine them while rejecting pixels flagged as suffering from latent image artifacts. The 70 μm BCD images were filtered using column filter and time filter IDL routines created by D. Fadda. These routines offer an improvement over the filtered BCD images generated by the pipeline by masking the position of the target(s) prior to filtering. MOPEX was used to align, resample, and combine the filtered MIPS images into final mosaics in all three MIPS bands.

For each mosaic (ch1-3), the background level has been measured and subtracted from the image. This value is recorded in the BACKGROU header keyword. Note that the filtering procedure used on the ch2 data removes most of the background, resulting in the very small, sometimes negative BACKGROU values recorded for those mosaics.

4.3. Treatment of MIPS Saturation Problems

The bright galactic nuclei in our sample presented saturation problems for many of the MIPS observations. The saturation limits for a 1-second observation of a point source are approximately 4 Jy, 18 Jy, and 3 Jy at 24, 70, and 160 μm , respectively. At 24 μm , a strong “jailbar” pattern with depressed responsivity in every fourth column appears around saturated sources; bright 24 μm sources may also saturate parts of the array, resulting in a DC offset that thwarts the pipeline’s default “droop correction” algorithm. Individual frames displaying these saturation problems were removed prior to the creation of the final mosaic with MOPEX using the remaining frames that did not display indications of saturation. The typical pattern in the data was several saturated images (strong jailbars) followed by useful, unsaturated data frames.

At 70 and 160 μ m, the Spitzer MIPS Ge Reprocessing Tools (GeRT) package was utilized to correct the BCDs for saturation problems. To fix saturated pixels, the GeRT mosaic was matched to the initial MOPEX mosaic by computing their ratio and scaling the GeRT mosaic appropriately. A pixel mask was then applied, and the missing pixel(s) from the GeRT mosaic were used to produce a corrected MOPEX mosaic. The GeRT was configured to require a minimum of two data samples to estimate the slope of the signal. Severely saturated images, which are saturated on the first or second point of the integration ramp, could not be recovered with the GeRT, and are thus unusable for photometry.

4.3.1 Saturated Galaxies

Galaxies in this delivery with saturated MIPS channel 1 (24 μ m) data are: NGC2146 and NGC4194.

Galaxies in this delivery with saturated MIPS channel 2 (70 μ m) data are: IRASF05189-2524, IRASF12112+0305, IRASF14348-1447, and Mrk231.

Galaxies in this delivery with saturated MIPS channel 3 (160 μ m) data are: Arp220, ESO173-G015, IRAS13120-5453, IRASF05189-2524, IRASF12112+0305, IRASF14348-1447, Mrk231, NGC0838, NGC2146, and NGC5010.

5. IRS Data Processing

Dedicated sky observations were used for sky subtraction of the high resolution IRS data. For the low resolution spectra, off-source nods were used for sky subtraction, unless dedicated sky observations were available. B-mask files were combined such that $bmask_final[i,j]=\max(bmask_N[i,j])$ where i,j are the pixel coordinates and the $bmask_Ns$ are the bmask files corresponding to each bcd in both the nod and the data used for sky subtraction. BCDs and “func” files for each nod were combined (median for $N>5$, average with 3-sigma clipping otherwise) as well.

Each nod was extracted with SPICE using the standard extraction aperture, and point-source calibration. Nod-1 and nod-2 were compared with each other, with pixels flagged if the difference between nod1 and nod2 exceeded 10%, and when adjacent pixels within the same nod differed by $>10\%$ (i.e., from a cosmic ray or hot pixel). Flagged pixels were excluded when the nods were combined into the final spectrum for each object. Order matching was performed on SL data. SL3 (the “bonus order”) was scaled to match SL1, then SL2 was scaled to match SL3. A sample spectrum of NGC6701 is shown in Fig. 1.

5.1 Notes on individual objects

Order mis-matches are sometimes seen in the IRS LH data. The IRS Instrument Support Team at the SSC is actively working towards a solution of this problem. Order mismatches are seen in the following objects: Arp220, ESO440-IG058, Mrk231

Spectral fringing is visible in the IRS LL spectra of the following objects
IRAS08572+3915, IRAS14378-3651, ESO148-IG002, IRAS23365+3604, Mrk231,
NGC4194, NGC6090

5.2 Photometric comparisons

As discussed in detail in the first GOALS delivery, IRS flux densities in the IRAC ch4 (8 μm) passband and MIPS ch1 (24 μm) passband were compared to flux densities from our imaging data. Boxes corresponding to the extraction aperture for the relevant spectrum (SL for IRAC 8 μm , LL or LH for MIPS 24 μm) were used to measure the corresponding flux densities from the imaging data. SL and IRAC 8 μm flux densities are in good agreement with each other, while LL and LH flux densities were systematically $\sim 20\%$ larger than MIPS 24 μm flux densities. The latter offsets are consistent with the offset seen between MIPS 24 μm and IRAS 25 μm : $f(24\mu\text{m MIPS}) = (0.80 \pm 0.16) f(24\mu\text{m IRAS intrp})$ where $f(24\mu\text{m IRAS intrp})$ is the IRAS flux density interpolated to the wavelength of MIPS ch1. Self-consistent color corrections using the full SED are expected to bring MIPS 24 μm measurements into consistency with IRAS and IRS (Lord 2008, private communication).

5.3 Spatial Profiles

Spatial profiles at three wavelengths in SL have been measured for all galaxies from the BCDs that were used in the SPICE extractions. The selected wavelengths are meant to isolate three features, namely the 8.6 μm PAH, 10 μm continuum, and 12.8 μm [NeII] fine-structure emission line. Note, however, that the [NeII] profile can include significant flux from the 12.7 μm PAH feature in addition to the fine-structure line. These are not easily separable without careful profile fitting in IRS low-res data. In all cases the profiles (e^{-1}/sec versus the pixel number in the X (spatial) direction across the processed 2D spectra) are median values over 5 pixels (in wavelength), and they are centered on the given feature in the observed frame. In SL, 1 pixel = 1.8 arcsec. Profiles for both nod positions are given in the delivered files. An example profile is shown below for UGC 3410 (Fig. 2). This source is clearly resolved in all three spectral features. The ratio of the integrated flux in the source along the slit, to that of the standard star, at the observed wavelengths of 12.8, 10, and 8.6 μm ($\mathcal{R}_{12.8}$, \mathcal{R}_{10} , $\mathcal{R}_{8.6}$), is given in Table 3 below. These ratios were obtained by dividing by the peak flux and then averaging the individual profiles at the two nod positions.

6. Derived Photometric Quantities

Table 2: Global IRAC and MIPS Photometry

Galaxy	IRAC-3.6 (Jy)	IRAC- 4.5 (Jy)	IRAC- 5.6 (Jy)	IRAC- 8 (Jy)	MIPS-24 (Jy)	MIPS-70 (Jy)	MIPS-160 (Jy)
NGC0023	0.117	0.075	0.158	0.395	0.95	10.09	13.53
NGC0232	0.051	0.035	0.086	0.244	0.86	10.53	14.01
MCG+12-02-001	0.068	0.054	0.199	0.553	3.31	22.60	21.55
ESO244-G012	0.053	0.035	0.136	0.271	1.60	9.80	7.90
UGC01385	0.028	0.019	0.047	0.131	0.82	5.95	6.67
NGC0838	0.073	0.052	0.197	0.603	1.58	12.46	13.97
IC0214	0.027	0.020	0.059	0.185	0.54	5.70	7.75
ESO420-G013	0.083	0.079	NA	0.379	1.98	14.67	15.62
NGC1797	0.058	0.040	0.067	0.243	1.08	9.21	10.95
IRASF05189-2524	0.100	0.129	0.256	0.329	3.16	NA	NA
UGC03410	0.096	0.065	0.193	0.511	0.71	10.75	19.13
NGC2146	0.936	0.672	2.579	6.564	16.70	130.75	NA
NGC2623	0.031	0.027	0.056	0.159	1.43	22.05	15.58
IRASF08572+3915	0.041	0.000	0.961	0.356	1.47	5.92	2.64
IRAS09022-3615	0.055	0.058	0.105	0.189	0.94	10.88	5.98
UGC05101	0.046	0.078	0.096	0.163	0.82	13.91	14.46
IRASF10565+2448	0.021	0.018	0.039	0.144	1.00	11.98	9.91
ESO319-G022	0.033	0.022	0.039	0.087	0.68	8.48	6.82
ESO440-IG058	0.043	0.029	0.081	0.219	0.61	7.96	10.30
IRASF12112+0305	0.009	0.006	0.009	0.056	0.37	NA	NA
NGC4194	0.093	0.077	0.264	0.684	NA	19.49	15.77
Mrk231	0.206	0.280	1.394	1.030	6.77	NA	NA
NGC5010	0.086	0.060	0.144	0.381	0.74	13.20	16.99
IRAS13120-5453	0.063	0.053	0.137	0.348	2.58	36.96	NA
ESO173-G015	0.143	0.110	0.399	1.038	6.78	62.67	NA
Mrk273	0.032	0.039	0.073	0.163	1.90	21.31	12.59
IRASF14348-1447	0.012	0.011	0.011	0.056	0.40	NA	NA
IRASF14378-3651	0.014	0.011	0.010	0.053	0.48	7.27	4.36
NGC5734	0.116	0.076	0.176	0.460	0.62	9.29	15.29
IRASF15250+3608	0.010	0.010	0.038	0.139	1.09	6.65	3.47
Arp220	0.054	0.045	0.137	0.285	6.30	83.00	NA
NGC6090	0.033	0.023	0.061	0.201	0.97	7.13	7.81
NGC6156	0.15	0.10	0.32	0.90	2.13	21.33	29.82
ESO453-G005	0.029	0.017	0.047	0.099	0.33	9.80	9.45
IRASF17132+5313	0.014	0.012	0.027	0.125	0.50	6.45	6.02
CGCG141-034	0.033	0.022	0.044	0.132	0.45	7.49	8.27
IRAS17578-0400	0.036	0.027	0.081	0.204	0.74	24.41	NA
IRASF19297-0406	0.033	0.021	0.018	0.071	0.41	7.27	7.42
MCG+04-48-002	0.076	0.057	0.159	0.407	0.76	10.64	14.39
ESO286-IG019	0.019	0.024	0.059	0.171	1.64	11.36	6.09
ESO467-G027	0.062	0.040	0.129	0.342	0.52	7.73	13.01
UGC12150	0.047	0.032	0.070	0.186	0.75	9.19	10.84
IRASF22491-1808	0.009	0.004	0.003	0.032	0.44	5.00	3.26
IC5298	0.037	0.045	0.048	0.150	1.46	8.88	7.32
ESO148-IG002	0.021	0.023	0.049	0.154	1.38	10.28	6.69
NGC7591	0.064	0.042	0.091	0.251	0.73	9.15	13.24

NGC7679	0.061	0.041	0.134	0.373	0.90	8.30	9.93
IRASF23365+3604	0.012	0.010	0.013	0.046	0.65	7.42	5.30
NGC7771	0.180	0.119	0.254	0.637	1.37	24.61	NA

Table 2 (above). IRAC and MIPS Global Photometry: Total fluxes in IRAC and MIPS for the delivered sources. Cols. 2-5 are IRAC bands 1-4, respectively. Cols. 6-8 are MIPS bands 1-3, respectively. All entries are in Jy.

Table 3: IRS Spatial Profiles

Galaxy	$\mathcal{R}_{12.8}$	\mathcal{R}_{10}	$\mathcal{R}_{8.6}$
NGC0023_id1	1.6	1.8	1.7
NGC0232_id1	1.0	1.1	1.1
MCG+12-02-001_id1	1.2	1.0	1.2
ESO244-G012_id1	1.0	1.0	1.0
UGC01385_id1	1.1	1.0	1.0
NGC0838_id1	1.4	1.4	1.4
IC0214_id1	1.7	1.8	1.8
ESO420-G013_id1	1.1	1.0	1.0
NGC1797_id1	1.1	1.0	1.1
IRASF05189-2524_id1	1.0	1.0	1.0
UGC03410_id1	2.1	2.3	2.2
NGC2146_id1	1.7	1.8	1.6
NGC2623_id1	1.0	1.3	1.0
IRASF08572+3915_id1	1.0	1.0	1.0
IRAS09022-3615_id1	1.0	1.0	1.0
UGC05101_id1	1.1	1.1	1.0
IRASF10565+2448_id1	1.0	1.0	1.0
ESO319-G022_id1	1.0	1.0	1.0
ESO440-IG058_id1	1.3	1.4	1.3
ESO440-IG058_id2	1.8	2.0	1.6
IRASF12112+0305_id1	1.1	1.1	1.2
NGC4194_id1	1.2	1.2	1.3
Mrk231_id1	1.2	1.0	1.0
NGC5010_id1	1.1	1.3	1.1
IRAS13120-5453_id1	1.0	1.0	1.0
ESO173-G015_id1	1.2	1.4	1.2
Mrk273_id1	1.0	1.0	1.0
IRASF14348-1447_id1	1.3	0.8	1.2
IRASF14378-3651_id1	1.0	1.0	1.0
NGC5734_id1	2.4	2.4	2.7
IRASF15250+3608_id1	1.0	1.0	1.0
Arp220_id1	1.1	1.2	1.0

NGC6090_id1	1.7	1.8	1.7
NGC6090_id2	1.3	1.2	1.3
NGC6156_id1	1.4	1.0	1.5
ESO453-G005_id1	1.6	2.3	1.8
IRAS17132+5313_id1	1.7	1.8	1.7
CGCG141-034_id1	1.0	1.0	1.0
IRAS17578-0400_id1	1.1	1.3	1.2
IRASF19297-0406_id1	1.0	1.0	1.0
MCG+04-48-002_id1	1.2	1.2	1.1
ESO286-IG019_id1	1.0	1.1	0.9
ESO467-G027_id1	1.8	2.0	1.9
UGC12150_id1	1.1	1.1	1.1
ESO148-IG002_id1	1.1	1.0	1.0
IC5298_id1	1.0	1.0	1.0
NGC7591_id1	1.2	1.6	1.2
NGC7679_id1	1.6	1.3	1.6
IRASF23365+3604_id1	1.0	1.0	1.0
NGC7771_id1	1.3	1.3	1.2

Table 3 (above). IRS Spatial profiles: Col. 2-4, the ratio of the integrated normalized flux in the source along the slit, to that of the standard star, at the rest wavelengths of 12.8, 10, and 8.6 μm , respectively.

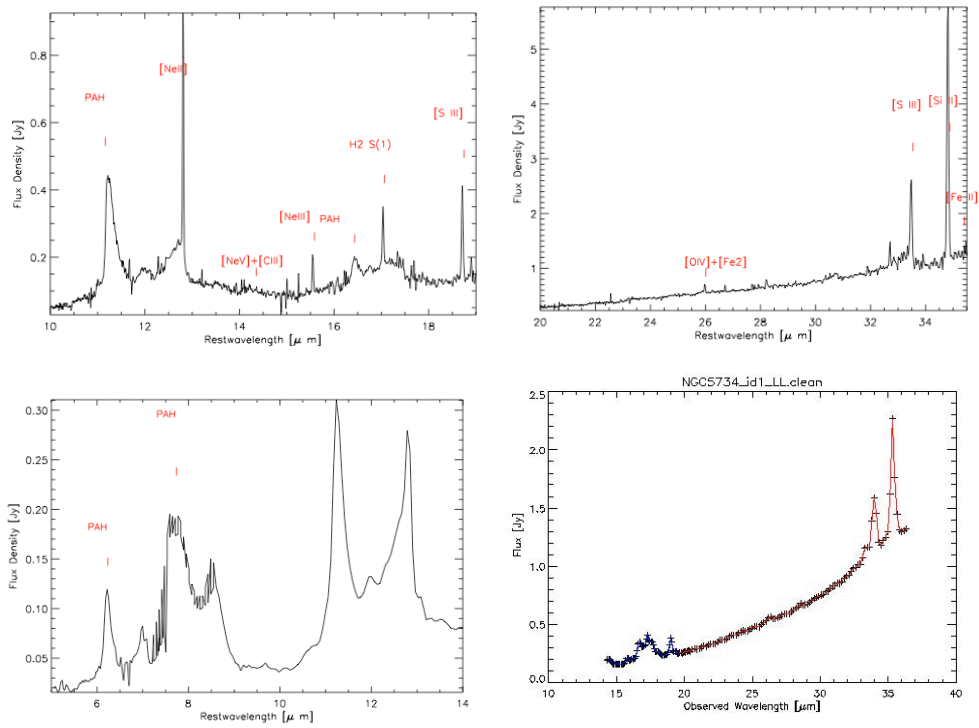


Fig. 1: IRS spectra for NGC5734. Short-high and Long-high are in the top left and right panels respectively. The insets show zoom-ins of the [NeV], [CIII] and [OIV], [FeII], emission lines. Short-low and Long-low data are shown in the bottom left and right panels.

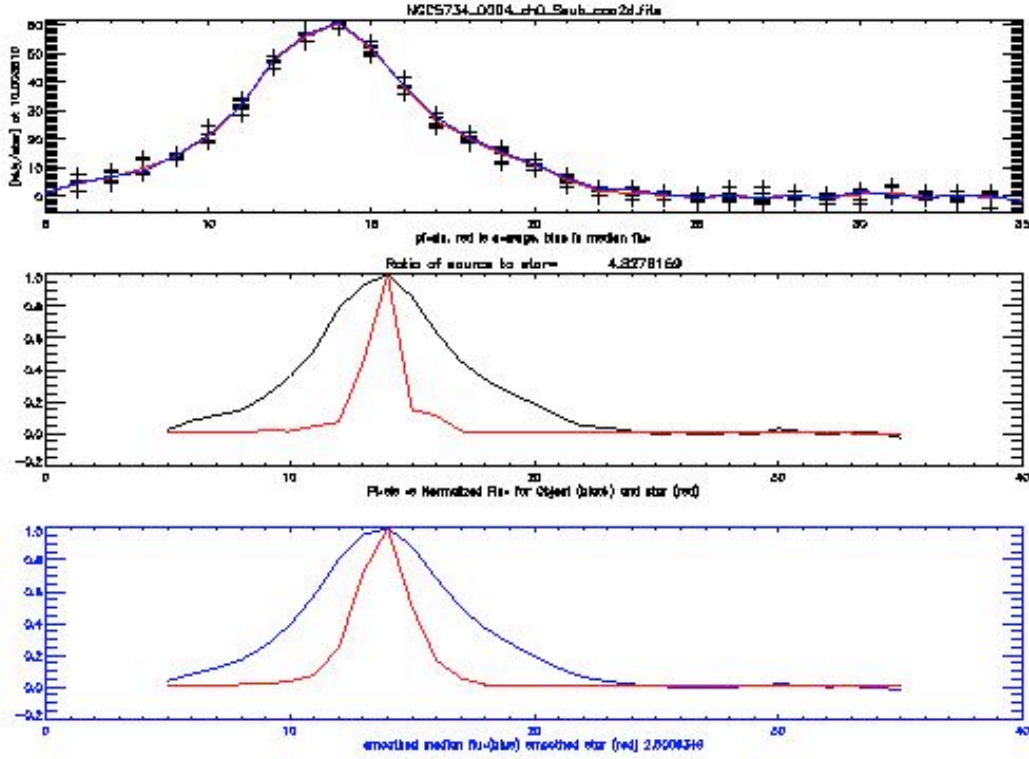


Fig. 2: Spatial profile of UGC 3410 along the IRS SL slit at a rest wavelength $10\ \mu\text{m}$ (see text for details). The top panel shows the profile of the galaxy, along with the values for each of the five pixels centered at $8.6\ \mu\text{m}$ (in the rest frame). The solid line is the median value at each pixel. The middle panel shows the profile of the galaxy (black) compared to that of a standard star (red) extracted in exactly the same manner, after aligning and normalizing to the peak surface brightness. In both cases the median value at each pixel is shown.