SPIRE Photometer Beam Profiles

Final beam profile derivation including shadow maps including HIPE 14 update (Bernhard Schulz, October 2015)

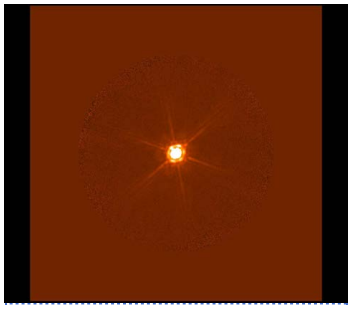
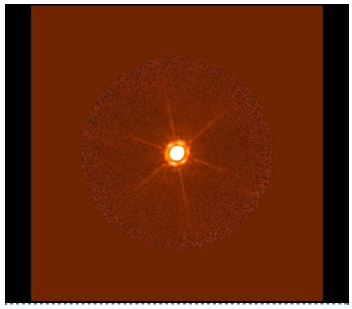
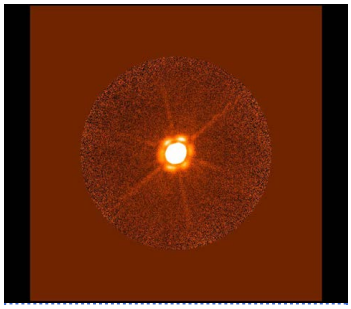
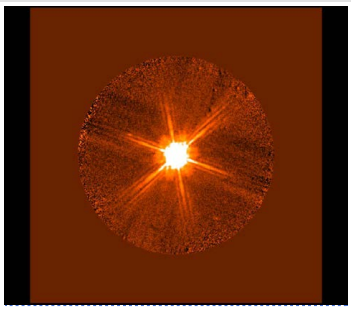
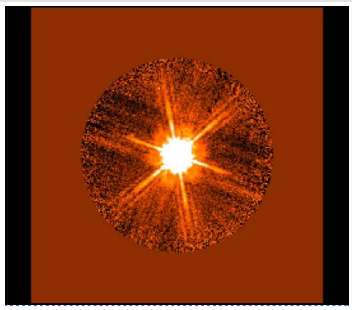
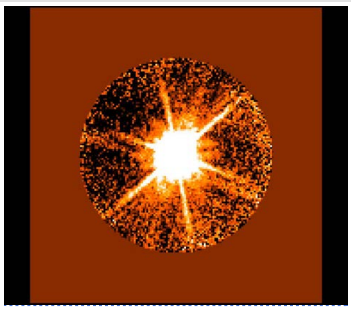
SPIRE Photometer Solid Angles

Solid angles in [arcsec^2]	PSW	PMW	PLW
Measured with Neptune spectrum	454.0+/-1.2	803.4+/-3.8	1700.0+/-13
SPIRE photometer reference spectrum (nu*F_nu = const.)	469.3+/-1.2	831.4+/-3.8	1804.3+/-13

The values in the first line were measured from a very finely sampled observation of Neptune as outlined below. Note that these are only accurate for a source of the same spectral shape. Since SPIRE flux densities for point sources are conventionally quoted for the reference wavelengths 250, 350, and 500 microns, assuming a source spectrum rising proportionally to wavelength (nu*F_nu=const.), we can adopt the same convention for (infinitely) extended sources. In this case the values in the second line apply. For sources of other colors a correction will have to be applied. The radial model beam profile is described in Griffin et al. 2013 and the data files given below can be used to calculate such beam profiles. This analysis showed that the static part of the model came from noise due to residual background galaxies and is not needed anymore. Rather the data show a well described fall-off with radius that is well described by a power-law. This fit is used to extrapolate beyond the measured radius.

Normalized Beam Profiles

The beam profile maps are available with all backgrounds subtracted and in a normalized form to the peak.

Detector Array	PSW	PMW	PLW
PSF with 1" pixel size and model extrapolation filling gaps and everything outside 750" radius (click on the image to enlarge)			
PSF with 1" pixels as FITS file	FITS file	FITS file	FITS file
PSF with standard pixel size (6", 10", 14") and model extrapolation filling gaps and everything outside 750" radius (click on the image to enlarge)			
PSF with standard pixel size as	FITS file	FITS file	FITS file

FITS file			

These files can also be found in the photometer calibration context of a SPIRE observation.

Radial Beam Profile Model

Datasets to construct the radial beam profile model are available below. These allow to take into account the color dependent FWHM of the true beam profiles. An updated implementation of the beam profile model in IDL is available for download.

The radial beam profile model for SPIRE was developed and described by Griffin et al. 2013. Taking the shadow observations into account revealed that the wavelength independent component of the model was just noise from residual background galaxies. The shadow observation allowed an almost complete subtraction, making this part obsolete. The updated IDL model reflects this accordingly and we correct the formula for the peak normalized monochromatic flux, depending on the distance from the peak (Theta), as follows:

$$P_{\mathrm{mod}}(\theta, \nu, \nu_{\mathrm{eff}}) = \max \begin{cases} P_{\mathrm{inner}}(\theta/(\nu/\nu_{\mathrm{eff}})^{\gamma}) \\ \cancel{P_{\mathrm{outer}}(\theta)} \end{cases}$$

A value of -0.85 is adopted for gamma, which controls the dependence of the FWHM of the variable part of the beam on wavelength. The reference frequency nu_eff is the isophotal frequency for the product of the spectrum of Neptune and the respective SPIRE spectral filter profile. The frequencies 1224.0683, 873.06788, 609.86168 GHz for PSW, PMW, PLW respectively make the model beam profile consistent with the measured Neptune beam using the spectral indices 1.29, 1.42, 1.47 respectively to describe the Neptune SED in the three filter bands. For verification run the test procedure "test_hs_broadbpsf", returning the following table in excellent agreement with the measured values:

Modeled solid angles in [arcsec^2]	PSW	PMW	PLW
Neptune spectrum	454	803	1700
SPIRE photometer reference spectrum (nu*F_nu = const.)	469	831	1804

*These values were updated for the HIPE 14 calibration mainly due to a normalization issue of the PLW beam.

Radial beam profile model	Values are given for radii in 1 arcsec steps starting at 0
Detector	**Radial beam profile**
PSW	point_src_sim_PSW.fits.gz
PMW	point_src_sim_PMW.fits.gz
PLW	point_src_sim_PLW.fits.gz

Updated IDL model

Analysis Details

The interested reader can find a detailed description of the data analysis that led to the data products.

Attachments

I	Attachment	History	Action	Size	Date	Who	Comment
	RadialBeamProfileModelFinal.png	r1	manage	15.3 K	2017-09-15 - 08:45	IvanV	