Detailed description of WISH DUSTY modelling

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Chapter 1

DUSTY modelling—Description, analysis and results

Here the results of DUSTY[1] (Ivezic & Elitzur 1997) modelling of the Class 0 and I envelopes observed as part of the "Water In Star-forming regions with Herschel" Key Programme are presented (van Dishoeck et al. 2011). The protostellar envelopes are modeled by examining the continuum emission from each source and couple that with the spectral energy distribution (SED), similar to the approach by Schöier et al. (2002) and Jørgensen et al. (2002).

The envelope density-structure is assumed to be described by a power-law such that $n \propto r^{-\alpha}$. The power-law index is determined by reproducing radial dust emission profiles of each source at two wavelengths, 450 and 850 μm. The continuum data are all obtained from the SCUBA Legacy Archive (Di Francesco et al. 2008). The second observational ingredient in the DUSTY modelling is the spectral energy distribution (SED), which is obtained from a literature search.

The strategy for the modelling is decribed in detail below, but here follows an overview:

- Run a large grid of DUSTY envelope models varying three parameters, the envelope size, Y, the power-law index of the density profile, α, and the optical depth of the envelope at 100 μm, τ_{100};
- Pick a value for Y and τ_{100};
- Compare the DUSTY images output at 450 and 850 μm to the observed radial profile and determine α;
- Compare the DUSTY SED to the observed SED; for SED values in a specific beam, compare the DUSTY results in that beam to observations and determine Y and τ_{100};

[1] DUSTY is available from http://www.pa.uky.edu/~moshe/dusty/

Table 1.1: Fixed DUSTY model parameters.

Fixed input parameters	
Stellar temperature, $T_\star$	5000 K
Dust temperature at r_i, $T_\mathrm{d}(r_\mathrm{i})$	250 K

- Modify Y and τ_{100} picked above and check whether this new choice influences the determination of α—if not, then the best-fit parameters have been determined; if α changes, check that the same values of Y and τ_{100} are still obtained or repeat until convergence; Extract physical parameters for the best-fit solution.

All scripts, models, input and output parameters are stored on the WISH computer, currently at `/disks/chem6/models/dusty/` in the Leiden computer system.

1.1 DUSTY grid

1.1.1 Input

The following input parameters were used for the DUSTY modelling. These follow very closely Jørgensen et al. (2002) and Schöier et al. (2002) and are provided in Table 1.1. The dust opacities of Ossenkopf & Henning (1994), Table 1, Column 5 are used. These correspond to a MRN grain size distribution (Mathis et al. 1977) with thin ice mantles after 10^5 years of coagulation at 10^6 cm^{-3}.

The output from DUSTY is unit-less. To calculate absolute values it is necessary to know the distance and bolometric luminosity. These are provided below in Table 1.2. The luminosities include all data available from 1 μm to 3mm, including 2MASS, *Spitzer*-IRAC and MIPS, *Herschel*-PACS, SCUBA, LABOCA, Bolocam, etc.

All density distributions are assumed to be described by a power-law such that $n \propto r^{-\alpha}$ where α is the density power law index, one of three variables. The other two are the size of the envelope expressed as the ratio of the envelope's outer and inner radius, $Y = r_\mathrm{out}/r_\mathrm{in}$ and the optical depth at 100 μm, τ_{100}. A grid of models was calculated with the following parameters:

- Density power law index, α: 0.5-2.3, step-size: 0.1
- Envelope thickness, Y: 100-3000, step-size: 100
- Optical depth at 100 μm, τ_{100}: 0.2-5.0, step-size:0.1 (extended to 9.0 for $\alpha = 1.8$ and to 7.0 for $\alpha = 1.5$)

to ensure that parameter space is properly explored.

Table 1.2: Distance and luminosity of the WISH sources.

Source	$L_{\rm bol}$ ($L_\odot$)	$T_{\rm bol}$ (K)	d (pc)
L1448	9.0	46.4	235
NGC1333 IRAS2A	35.7	50.4	235
NGC1333 IRAS4A	9.1	32.6	235
NGC1333 IRAS4B	4.4	27.8	235
L1527	1.9	44.1	140
Ced110 IRS4	0.8	55.6	125
BHR71	14.8	44.4	200
IRAS15398	1.2	52.3	150
L483	10.2	49.2	200
Ser SMM1	30.4	39.1	230
Ser SMM4	1.9	25.7	230
Ser SMM3	5.1	37.6	230
L 723	3.6	38.7	300
B335	3.3	36.1	250
L1157	4.7	46.4	325
NGC1333 IRAS3	41.8	148.6	235
L1489	3.8	199.7	140
L1551-IRS5	22.2	94.3	140
TMR1	3.8	133.4	140
TMC1A	2.7	117.5	140
TMC1	0.9	101.1	140
HH46	27.9	103.8	450
IRAS12496	35.4	569.1	178
GSS30-IRS1	13.9	142.0	125
Elias29	14.1	298.7	125
Oph-IRS63	1.3	327.0	125
RNO91	2.6	339.5	125
RCrA-IRS5	7.1	126.1	170
HH100	17.7	256.4	170

1.1.2 Output

All output files have been saved. These are presently located at /disks/chem6/models/dusty_model/ in the STRW system. What is most important for this project is, that artificial "images" at 450 and 850 μm have been constructed, consisting of a radial emission profile. To compare the profiles with the observed radial emission profile the model-profile is interpolated onto a 2D map and then convolved with the appropriate beam and error beam. The beam sizes in the SCUBA Legacy Archive are 14.″0 and 19.″5 at 450 and 850 μm, respectively, and the error beam is approximated by a 40″ Gaussian at both wavelengths. The intensity ratio of the main beam and error beam is 0.88:0.12 at both wavelengths. Finally, the radial profile is calculated in the same manner as the observed profile.

The SED is also explicitly output. It is normalized to the bolometric luminosity, i.e. the integral of the model SED is equal to one. To compare with observations, the modelled SED is interpolated to the observed wavelengths.

1.2 Observed radial profiles

To quantify the continuum emission from each source and to compare it directly to the results obtained from DUSTY, radial emission profiles of each source were constructed in the following manner:

1. A map was made of each source at both wavelengths.
2. The map was then divided into four quadrants centered on the source.
3. If any of the quadrants showed irregularities, e.g., if there were another source close by or if there was a bad receiver, then that particular quadrant was ignored. The bad quadrants are flagged in the image section (see below).
4. The radial profiles were constructed by taking the mean value of the emission in annulii with varying radii around the centre of emission. The width of each annulus was approximately half the beam width and kept constant for each annulus.
5. All values are normalized to the value of the first point.
6. The SCUBA archive contains error maps for each emission map and the errors were calculated in the same manner as the emission profile.

Four of the southern sources have not been observed by SCUBA. Fake radial emission profiles were created by constructing an image where the emission falls off from the centre pixel as $r^{-1.5}$. The image was then convolved with the beam and error beam and the radial profile extracted as described above.

1.3 Spectral energy distribution

The SED for each source was constructed by doing an extensive literature search. In particular, *Herschel*-PACS data are included. This is not the only attempt at collecting complete SEDs from the literature. As it was afterwards discovered, the star-formation group in Kent is doing the same (Froebrich 2005). Their website contains a large amount of useful information: http://astro.kent.ac.uk/protostars/ including SEDs for 175 Class 0/I protostars. This library is completely referenced.

For the DUSTY modelling, only flux points from PACS, SCUBA/LABOCA and Bolocam/SEST are included, thus no points at wavelengths shorter than 60 μm. The SCUBA/LABOCA and Bolocam/SEST points are in beams smaller than the envelope, and the DUSTY images are therefore used to extract model emission in the same beam. SCUBA fluxes from the Fundamental Catalogue of the Legacy Archive were used and fluxes were extracted in a 17.″3 and 22.″9 beam at 450 and 850 μm, respectively. The PACS data were carefully examined by eye, and all continuum emission from each source extracted by summing up emission from each spaxel.

As discussed in Jørgensen et al. (2002) some of these sources may have disks whereas only the protostellar envelope is modeled here. Disk emission may in some cases contribute as much as 30-75% at 1.1 mm in a 19″ beam (Hogerheijde et al. 1997). The effects of disks have not been taken into account at all.

The uncertainty on PACS and Bolocam/SEST data points have been taken to 30% following the arguments of Jørgensen et al. (2002). The SCUBA/LABOCA data points are assigned an unrealistically low uncertainty of 1% to force the best-fit solution to agree with these data points. Typically, the envelope mass is obtained by assuming that the continuum emission is optically thin at sub-mm wavelengths, and that the envelope is an isothermal sphere.

1.4 Analysis

To quantify how well a model output reproduces the observations a χ^2 approach is used. That is, for each point on the radial profile and for each point on the SED

$$\chi^2 = \frac{1}{f} \sum_{\text{obs}} \left(\frac{X_{\text{mod}} - X_{\text{obs}}}{\sigma_{\text{obs}}} \right)^2 \tag{1.1}$$

where f is the degrees of freedom (i.e. total number of observed points minus number of fitting parameters), X the observed/modelled value and σ the uncertainty. The best fit model corresponds the lowest value of χ^2.

First, the density power-law index, α, is determined by reproducing the SCUBA image with the model images and by assuming a constant value of Y and τ_{100}. Once α is determined, Y and τ_{100} are determined by fitting the SED (and taking the appropriate beam into account). The constant values of Y and τ_{100} are then

updated and a new value for the slope, α, is determined. The process is repeated until the best-fit model has been found; in practice this requires 1–2 iterations only. For all envelopes, Y is constrained to the interval 45–90″ following the discussion in Young et al. (2006). For high-luminosity sources with $r_{\rm in} \times Y_{\rm min} = 500 r_{\rm in} < 45''$, Y is varied between 500 and 1000. For each source, a χ^2 plot is shown for both the determination of α and of Y and τ.

Once the best-fit model has been found, the scale-free DUSTY model is given physical dimensions. First, the total H_2 column density in a pencil beam towards the central source is calculated from:

$$\tau_\lambda = \int \kappa_\lambda \, \delta \, \mu_{\rm H2} \, n({\rm H_2}) \, {\rm d}r = \kappa_\lambda \, \delta \, \mu_{\rm H2} \, N({\rm H_2}), \tag{1.2}$$

where κ_λ is the dust and gas opacity, in this case at 100 μm, δ is the gas-to-dust mass ratio and is taken to be 100 here, $\mu_{\rm H2}$ is the mean molecular mass with respect to H_2, which is 2.8 (Kauffmann et al. 2008). From this equation, the local density may be derived at any point in the envelope, the total mass is inferred, etc.

The envelopes are taken to transit from a protostellar envelope to cloud material at a temperature of 10 K. Thus, the envelopes are effectively truncated at this temperature and envelope parameters are often calculated using the r(10 K) radius rather than the outer radius obtained through the DUSTY modelling. In particular, the pencil-beam column density towards the central object is re-calculated using the new outer radius, unlike what was done in, e.g., Jørgensen et al. (2002). A number of envelope properties are extracted and tabulated:

- inner and outer radius, $r_{\rm in}$ and $r_{\rm out}$, where the outer radius is the minimum radius where either the dust temperature reaches 10 K or the density reaches 10^4 cm^{-3};
- local number density at $r_{\rm in}$, $r_{\rm out}$ and 1000 AU;
- column density from $r_{\rm in}$ to $r_{\rm out}$;
- total envelope mass contained within $r_{\rm out}$.

1.5 Results and small discussion

In the following detailed results are provided for each object. In Table 1.3 the best-fit results are provided for each object along with the best-fit results from Jørgensen et al. (2002) where available.

1.5.1 Comparison to Jørgensen et al. (2002)

In general there is good agreement between the power-law indices, with differences of less than 0.2. Only three sources show larger variations with a difference of 0.3 (L1527, L723 and TMC1A). The small variations are because essentially the same

dataset is used for deriving the power-law index. The values of τ and Y show more variation, likely caused by the very different datasets used in determining these parameters. With the *Herschel*-PACS data, the peak of the SED is measured and τ_{100} is therefore determined more accurately than was previously possible. The extent of the envelope, on the other hand, is largely unconstrained.

The inferred masses are larger for the current DUSTY modelling compared to the previous results of Jørgensen et al. (2002). Part of this discrepancy is explained by Jørgensen et al. using a mean molecular weight of 2.0 with respect to H_2, thus accounting for a 40% difference in mass. In order to do a quick sanity check of the inferred masses, the peak SCUBA/LABOCA flux density at 850/870 μm was converted to mass, assuming that the dust emission is optically thin and that the envelopes are described as a single isothermal sphere. For this exercise, a dust temperature of 15 K was taken. Because only the peak flux in a $\sim 20''$ beam is used, the measured envelope mass is a lower limit to the true envelope mass, and the DUSTY mass should be larger than this value by up to a factor of 2–3. Only one sources shows a value of $M_{\rm SCUBA} < M_{\rm Dusty}$, Ser SMM4 (2.1 versus 2.4 $M_\odot$).

1.5.2 Disk contribution

So far, any disk contribution to the envelope radial profile and SED has been ignored. For the deeply embedded Class 0 sources, ignoring the disk plays a minor role in determining the envelope parameters because more than 90% of the emission at any wavelength is from the envelope (Jørgensen et al. 2009). For Class I sources, however, the disk may contribute significantly more, up to 50% of the emission at a given wavelength. It is beyond the scope of this modelling project to properly account for the disk contribution. For a more thorough review, the reader is referred to, e.g., Crapsi et al. (2008). The presence of small-scale structure at all evolutionary stages implies that the derived DUSTY parameters are not valid on scales of at least 10–100 AU for all objects.

The presence of a disk has two effects: (1) the power-law density profile becomes slightly steeper because the disk serves as an extra flux-point at small radii; (2) the bolometric luminosity is an upper limit to the envelope luminosity. To test the effects quantitatively, TMC1A was chosen as a test object and test results are summarised in Fig. 1.1–1.4 and Tables 1.6–1.9. The first test consists of flattening the density profile artificially by decreasing α from 1.6 to 1.4 and 1.2 to essentially remove the disk contribution to the radial emission profile. Y and τ_{100} are then re-determined following the procedure outlined above. For both new envelopes did the mass increase from 0.33 $M_\odot$ to 0.3 and 0.55 $M_\odot$, respectively. The temperature profiles show very little difference (Fig. 1.1) when plotted as a function of radius. When plotted as a function of enclosed mass, there is a significantly larger spread between the models, and the model with the largest slope ($\alpha = 1.6$) contains more mass at the highest temperatures. The model with the intermediate slope ($\alpha = 1.4$)

Table 1.3: Best-fit model solutions. When available, best-fit model solutions from Jørgensen et al. (2002) are provided (subscript "J").

Source	Y	$Y_{\rm J}$	α	$\alpha_{\rm J}$	τ	$\tau_{\rm J}$
L1448	900	1600	1.5	1.4	3.2	0.5
NGC1333 IRAS2A	500	900	1.7	1.8	1.5	1.6
NGC1333 IRAS4A	1000	1000	1.8	1.8	7.7	6.5
NGC1333 IRAS4B	800	1400	1.4	1.3	4.3	0.9
L1527	1200	2500	0.9	0.6	0.3	0.1
Ced110-IRS4	1400	—	1.4	—	0.5	—
BHR71	500	—	1.7	—	2.0	—
IRAS15398	1000	—	1.4	—	1.7	—
L483	1000	1400	0.9	0.9	0.2	0.3
Ser SMM1	500	—	1.3	—	2.0	—
Ser SMM4	1600	—	1.0	—	2.4	—
Ser SMM3	1200	—	0.8	—	0.4	—
L723	2800	2500	1.2	1.5	0.5	1.0
B335	1200	—	1.4	—	1.4	—
L1157	2200	600	1.6	1.7	2.5	3.4
NGC1333 IRAS3	1000	—	1.5	—	1.2	—
L1489	800	—	1.5	—	0.2	—
L1551-IRS5	900	1000	1.8	1.8	1.5	1.1
TMR1	900	2000	1.6	1.6	0.3	0.1
TMC1A	900	1700	1.6	1.9	0.4	1.4
TMC1	1800	2900	1.1	1.6	0.1	0.2
HH46	800	—	1.6	—	1.0	—
IRAS12496	800	—	1.6	—	1.3	—
GSS30-IRS1	1000	—	1.6	—	0.2	—
Elias 29	1000	—	1.6	—	0.1	—
Oph-IRS63	900	—	1.6	—	1.4	—
RNO91	900	—	1.2	—	0.2	—
RCrA-IRS5	1000	—	0.8	—	0.1	—
HH100	1000	—	0.5	—	0.1	—

Table 1.4: Best-fit model predictions. These are (when possible) compared to model results from Jørgensen et al. (2002).

Source	r(10K) (AU)	r_J(10K) (AU)	M(10K) ($M_\odot$)	M_J(10K) ($M_\odot$)	n_H(1000 AU) (cm^{-3})	$n_{H,J}$(1000 AU) (cm^{-3})	N_{H2}(10 K) (cm^{-2})	$N_{H2,J}$ (cm^{-2})
L1448	6.1(3)	8.1(3)	3.9	0.93	3.9(6)	7.5(5)	7.7(23)	1.7(23)
NGC1333 IRAS2A	1.7(4)	1.2(4)	5.1	1.7	1.7(6)	1.5(6)	3.7(23)	5.5(23)
NGC1333 IRAS4A	6.9(3)	4.7(3)	5.6	2.3	6.7(6)	6.3(6)	1.9(24)	2.2(24)
NGC1333 IRAS4B	3.8(3)	7.0(3)	3.0	2.0	5.7(6)	1.8(6)	1.0(24)	3.0(23)
L1527	4.6(3)	6.3(3)	0.9	0.91	8.1(5)	3.8(5)	6.9(22)	2.8(22)
Ced110-IRS4	3.4(3)	—	0.2	—	3.9(5)	—	1.2(23)	—
BHR71	9.9(3)	—	2.7	—	1.8(6)	—	4.9(23)	—
IRAS15398	2.7(3)	—	0.5	—	1.6(6)	—	4.1(23)	—
L483	1.2(4)	1.0(4)	4.4	4.4	5.1(5)	1.0(6)	4.9(22)	9.3(23)
Ser-SMM1	1.2(4)	—	16.1	—	4.1(6)	—	4.9(23)	—
Ser-SMM4	2.8(3)	—	2.1	—	5.4(6)	—	4.8(23)	—
Ser-SMM3	6.7(3)	—	3.2	—	1.1(6)	—	8.7(22)	—
L723	6.6(3)	2.1(4)	1.3	0.62	8.0(5)	1.1(6)	1.1(23)	3.4(23)
B335	4.9(3)	—	1.2	—	1.5(6)	—	3.4(23)	—
L1157	5.4(3)	5.4(3)	1.5	1.6	2.0(6)	3.3(6)	6.1(23)	1.2(24)
NGC1333 IRAS3	1.8(4)	—	9.5	—	1.9(6)	—	3.0(23)	—
L1489	6.7(3)	9.4(3)	0.2	0.097	1.9(5)	1.2(5)	5.9(22)	1.0(23)
L1551-IRS5	1.4(4)	2.5(4)	2.3	1.7	1.2(6)	1.1(6)	3.7(23)	3.8(23)
TMR1	7.9(3)	1.2(4)	0.2	0.12	2.1(5)	6.9(4)	8.9(22)	3.5(22)
TMC1A	6.7(3)	4.8(3)	0.2	0.13	2.2(5)	3.7(5)	9.9(22)	4.5(23)
TMC1	5.0(3)	4.3(3)	0.2	0.034	1.8(5)	8.8(4)	2.4(22)	6.9(22)
HH46	1.7(4)	—	4.4	—	1.2(6)	—	2.5(23)	—
IRAS12496	6.1(3)	—	0.8	—	9.2(5)	—	3.2(23)	—
GSS30-IRS1	1.6(4)	—	0.6	—	1.7(5)	—	4.9(22)	—
Elias29	1.6(4)	—	0.3	—	8.3(4)	—	2.5(22)	—
Oph-IRS63	3.2(3)	—	0.3	—	6.9(5)	—	3.4(22)	—
RNO91	6.0(3)	—	0.5	—	3.3(5)	—	4.9(22)	—
RCrA-IRS5	1.0(4)	—	2.0	—	2.8(5)	—	2.5(22)	—
HH100	1.6(4)	—	8.1	—	2.2(5)	—	2.5(22)	—

Table 1.5: DUSTY-inferred envelope masses compared to SCUBA-measured envelope masses (in this case, SCUBA refers to continuum measurements at 850/870 μm, i.e., either SCUBA or LABOCA measurements).

Source	$M_{\rm DUSTY}$ ($M_\odot$)	$M_{\rm SCUBA}$ ($M_\odot$)
L1448	3.9	1.1
NGC1333 IRAS2A	5.1	1.7
NGC1333 IRAS4A	5.6	5.4
NGC1333 IRAS4B	3.0	2.6
L1527	0.9	0.3
Ced110-IRS4	0.2	0.1
BHR71	2.7	—
IRAS15398	0.5	0.4
L483	4.4	0.8
Ser SMM1	16.1	4.4
Ser SMM4	2.1	2.4
Ser SMM3	3.2	1.3
L723	1.3	0.8
B335	1.2	0.8
L1157	1.5	1.4
NGC1333 IRAS3	9.5	2.3
L1489	0.2	0.1
L1551-IRS5	2.3	0.9
TMR1	0.2	0.1
TMC1A	0.2	0.1
TMC1	0.2	0.1
HH46	4.4	2.0
IRAS12496	0.8	0.8
GSS30-IRS1	0.6	0.1
Elias 29	0.3	0.1
Oph-IRS63	0.3	0.2
RNO91	0.5	0.1
RCrA-IRS5	2.0	0.4
HH100	8.1	0.6

containes the most mass from $T \gtrsim 100$ K and outwards. Note, though, that the enclosed mass is of the order of $\sim 10^{-4}$ $M_{\odot}$ or less, and that the physical scale is < 30 AU, i.e., the region where the DUSTY models are known to break down.

The second test consisted of decreasing first the SCUBA 450 and 850 μm flux densities by 10, 20, 30 and 40%, but keeping the bolometric luminosity constant. Such a scenario is plausible if the inner envelope is moderately optically thick at 100 μm, i.e., if the PACS fluxes are coming from the envelope but the sub-mm fluxes have a significant contribution from the disk. For this exercise, the power-law density profile index is kept constant at the best-fit value of 1.6. As expected for optically thin dust emission, the envelope masses decrease by the amount of sub-mm flux subtracted. The density profiles remain nearly the same, but τ_{100} decreases. The temperature profiles change very little (see Fig. 1.2), even as a function of the enclosed mass.

The third test consists of decreasing all the observed fluxes by 10, 20, 30 and 40%, and also decreasing the envelope luminosity by the same amount. Such a scenario probably closer to the truth, if one considers that the warm disk will also contribute emission to the peak of the SED, and hence the bolometric luminosity. The slightly decreasing envelope luminosity leads to slightly shallower profiles (α = 1.5 if more than 10% of $L_{\rm env}$ is subtracted, vs. 1.6 in the standard best-fit model). The new envelopes are decreasing in mass from 0.33 to 0.20 $M_{\odot}$. The temperature profiles, however, remain nearly identical (Fig. 1.3).

The final test consist of combining tests one and three, i.e., changing the power-law density slope index to 1.2 and decreasing the envelope luminosity by 40%. Interestingly, the total envelope mass only changes by $\sim$ 10% because the two effects largely cancel eachother out. However, in the flat, low-luminosity envelope, the mass of the gas with $T > 100$ K is an order of magnitude lower than the standard best-fit model. Thus, the disk may lead to an over-estimate of the amount of warm gas in the inner envelope, as would be expected.

The tests described above only serve as a rough estimate of the effects a disk would have on the DUSTY modelling. A Class I source with a disk comparable in mass to the remnant envelope (e.g., Oph-IRS63) has an SED peaking at wavelengths shorter than 60 μm, and the peak is therefore not constraining the envelope any more. To do a proper fit of the SED, the disk will need to be explicitly included in the modelling as done in the Robitaille models. However, when including a disk in the models, the input parameter space opens up significantly.

Besides serving as a test for how much a disk would influence the DUSTY results, these tests also show how sensitive the models are to changes in best-fit parameters. For example, the SCUBA fluxes are typically associated with $\sim$ 20% calibration uncertainties, and the same holds for the PACS fluxes, i.e., $L_{\rm bol}$ as well. If the true flux is at the lower limit of the measured value, uncertainties in the DUSTY modelling will lead to an uncertainty on the inferred mass by as much as 30%. The density at 1000 AU is more sensitive to changes in envelope parameters, and certain combinations of parameters may lead to a decrease by more than a factor of 2.

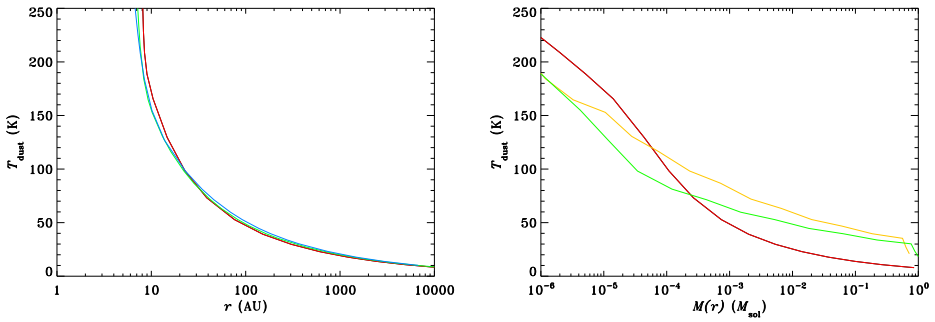

Figure 1.1: *Left:* Dust temperature as a function of distance through the envelope for the different power-law density slopes, α = 1.6 (red), 1.4 (green) and 1.2 (blue). *Right:* Dust temperature as a function of enclosed mass for the same power-law slopes.

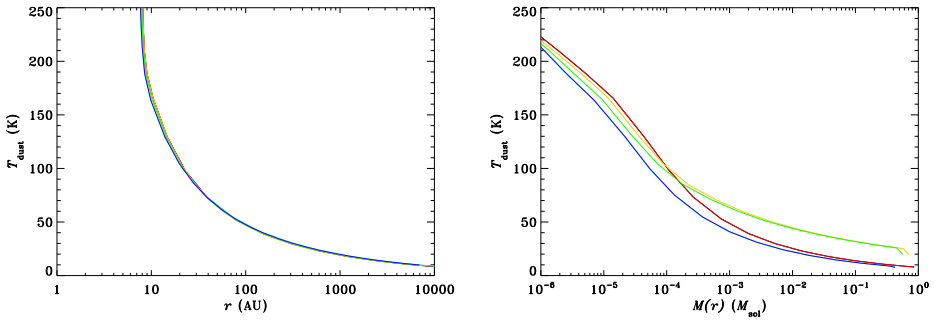

Figure 1.2: *Left:* Dust temperature as a function of distance through the envelope when the sub-mm and mm fluxes are decreased by 0% (red), 10% (yellow), 20% (green), 30% (cyan) and 40% (blue). *Right:* Dust temperature as a function of enclosed mass for the same decreases in sub-mm and mm fluxes.

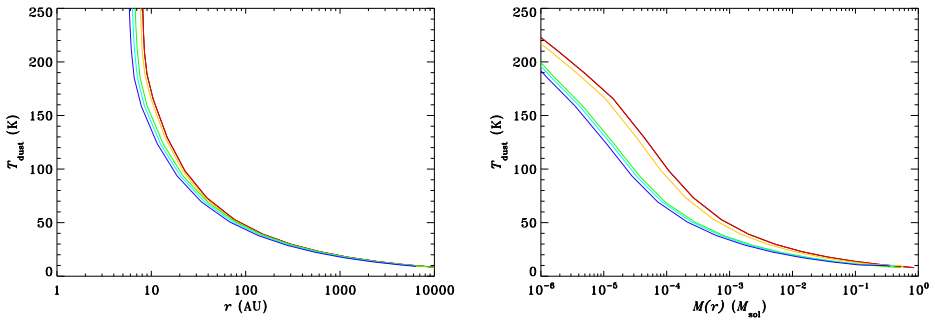

Figure 1.3: *Left:* Dust temperature as a function of distance through the envelope when all fluxes and the envelope luminosity are decreased by 0% (red), 10% (yellow), 20% (green), 30% (cyan) and 40% (blue). *Right:* Dust temperature as a function of enclosed mass for the same decreases in sub-mm and mm fluxes.

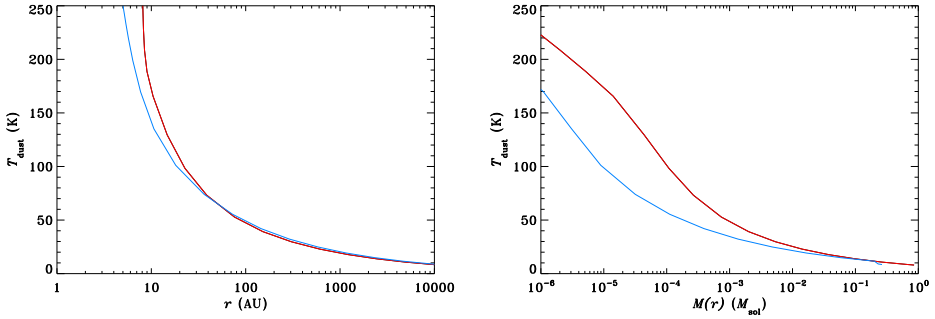

Figure 1.4: *Left:* Dust temperature as a function of distance through the envelope when all fluxes and the envelope luminosity are decreased by 40% and the envelope has a flatter density profile, $\alpha = 1.2$ (blue). The standard best-fit model is shown in red. *Right:* Dust temperature as a function of enclosed mass.

Table 1.6: Model results for test 1 where the power-law density slope was changed.

Parameter	Best-fit	$\alpha = 1.4$	$\alpha = 1.2$
α	1.6	1.4	1.2
Y	1400	1800	1000
τ_{100}	0.6	0.3	0.2
$r_{\rm in}$ (AU)	8.12	7.18	6.74
n(1000 AU) (cm^{-3})	4.02(5)	2.89(5)	3.24(5)
$M_{\rm env}$(10 K) ($M_\odot$)	0.33	0.39	0.55

Table 1.7: Model results for test 2, where the sub-mm fluxes were decreased.

Parameter	Best-fit	−10%	−20%	−30%	−40%
α	1.6	1.6	1.6	1.6	1.6
Y	1400	900	900	1800	900
τ_{100}	0.6	0.6	0.5	0.4	0.4
$r_{\rm in}$ (AU)	8.12	8.12	7.91	7.67	7.68
n(1000 AU) (cm^{-3})	4.02(5)	3.36(5)	2.76(5)	2.15(5)	2.17(5)
$M_{\rm env}$(10 K) ($M_\odot$)	0.33	0.29	0.26	0.25	0.22

1.5.3 The specific case of DK Cha, IRAS12496

DK Cha is the source with the highest bolometric temprature ($T_{\rm bol}$ = 570 K) and the peak of the SED is around 60 μm (when the SED is shown in F_ν units, Jy). The envelope is known to be very dilute, and the disk is large. However, very little has been done to quantify sub-mm disk emission from this source, primarily due to a lack of facilities in the southern hemisphere capable of observing the disk. Naturally, this situation will change soon with ALMA.

If the disk is seen face on (the very compact outflow suggests this to be the case), the disk contribution to PACS and shorter wavelength fluxes is likely very large. Therefore, the envelope luminosity is recalculated but only taking flux points with $\lambda > 90\,\mu$m into account. The "envelope" luminosity is then 4.5 $L_\odot$ as opposed to 35.4 $L_\odot$. Second, the sub-mm and mm fluxes are reduced by a factor of 2,

Table 1.8: Model results for test 3 where all fluxes and the envelope luminosity were decreased.

Parameter	Best-fit	−10%	−20%	−30%	−40%
α	1.6	1.6	1.5	1.5	1.5
Y	1400	1000	1600	1000	1100
τ_{100}	0.6	0.6	0.4	0.4	0.4
$r_{\rm in}$ (AU)	8.12	7.70	6.74	6.31	5.84
n(1000 AU) (cm^{-3})	4.02(5)	3.25(5)	2.78(5)	2.71(5)	2.60(5)
$M_{\rm env}$(10 K) ($M_\odot$)	0.33	0.27	0.28	0.23	0.20

Table 1.9: Model results for the combination of test 1 and 3, where the power-law density slope was fixed at 1.2 and the fluxes and envelope luminosity decreased by 40%.

Parameter	Best-fit	α = 1.2, −40%
α	1.6	1.2
Y	1400	2600
τ_{100}	0.6	0.1
$r_{\rm in}$ (AU)	8.12	5.01
n(1000 AU) (cm^{-3})	4.02(5)	1.44(5)
$M_{\rm env}$(10 K) ($M_\odot$)	0.33	0.30

following the discussion of the influence of a disk (see above). Finally, Bas Nefs finds in his research project that DK Cha has the steepest power-law index, $\alpha = 2.1$, of the three sources he studied (IRAS12553, DK Cha and HH46). I have chosen to let the power-law index stay at 1.6 to remove the contribution of the disk to the envelope.

All of these more or less arbitrary steps in the modelling of DK Cha are necessary, or a model that takes both disk and envelope (and potentially the star itself) into account is required. As concluded above, doing a disk + envelope model based on the SED alone is not feasible, as the number of free parameters is very large and many of them are not constrained from the SED.

Chapter 2

L 1448

2.1 Input data: radial profile, luminosity and SED

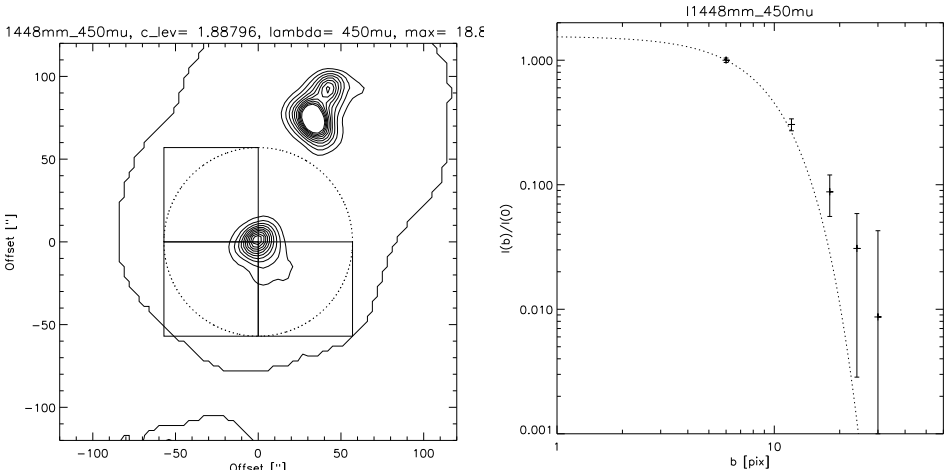

Figure 2.1: Map and radial emission profile of L 1448 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
l1448mm
=========================
Luminosity =      9.00000
Distance =      235.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

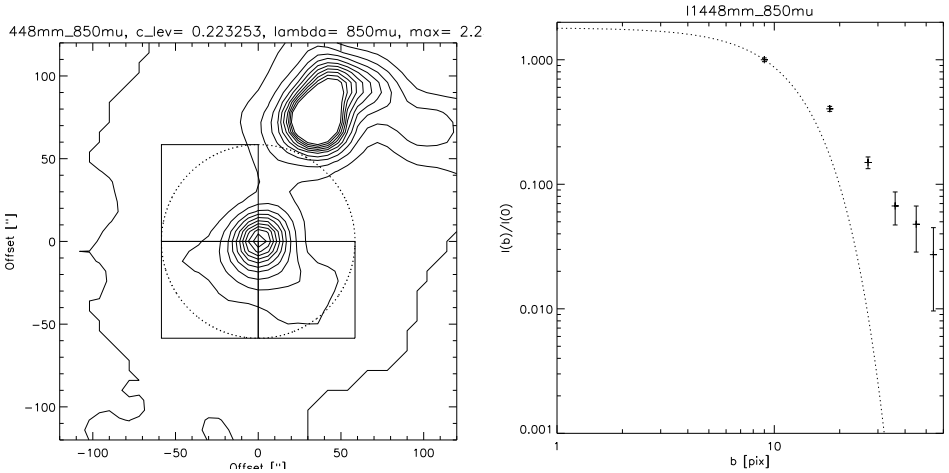

Figure 2.2: Map and radial emission profile of L 1448 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.47179800
       18.000000       0.24158700
       24.000000       0.15016000
       30.000000       0.12764800
       36.000000       0.10011500
       42.000000      0.062256100
       48.000000      0.041341200

850 mu:
       9.0000000        1.0000000
       18.000000       0.47759200
       27.000000       0.21716300
       36.000000       0.12950600
       45.000000      0.099406900
       54.000000      0.076163800

SED:
       60.000000   1.6296211e-16
       70.000000   2.1047177e-16
       80.000000   2.4629490e-16
       90.000000   3.2335366e-16
       110.00000   3.1196824e-16
```

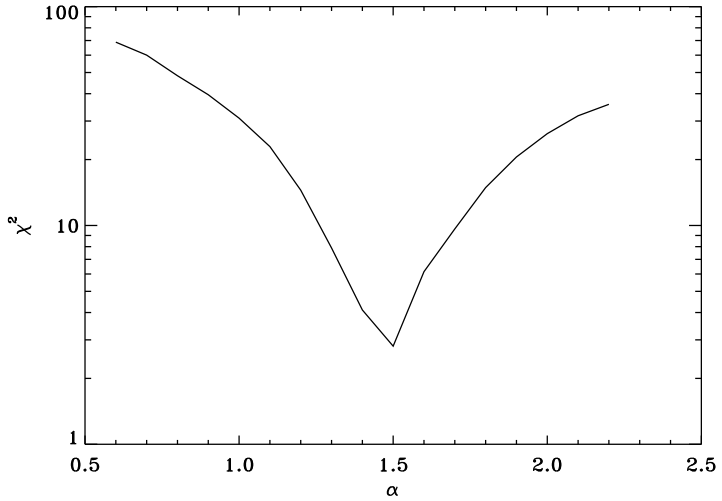

Figure 2.3: Reduced χ^2 as a function of the power-law density slope, α.

```
120.00000   2.9393609e-16
130.00000   2.8554525e-16
140.00000   2.7484465e-16
150.00000   2.5355131e-16
160.00000   2.4887090e-16
170.00000   2.1121873e-16
180.00000   2.0458627e-16
450.00000   2.2800001e-17
850.00000   1.8847060e-18
1100.0000   2.6727274e-19
```

All SED points are in units of W m^{-2}.

2.2 χ^2 results

2.2.1 DUSTY parameters

2.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
               r1 [AU] =     20.66
           r(10K) [AU] =  6.10e+03
             ni [cm-3] =  1.32e+09
      n(1000 AU) [cm-3] =  3.92e+06
         n(10 K) [cm-3] =  2.60e+05
     N(H2)(10 K) [cm-2] =  7.69e+23
Envelope mass(10K) [MS] =     3.905
```

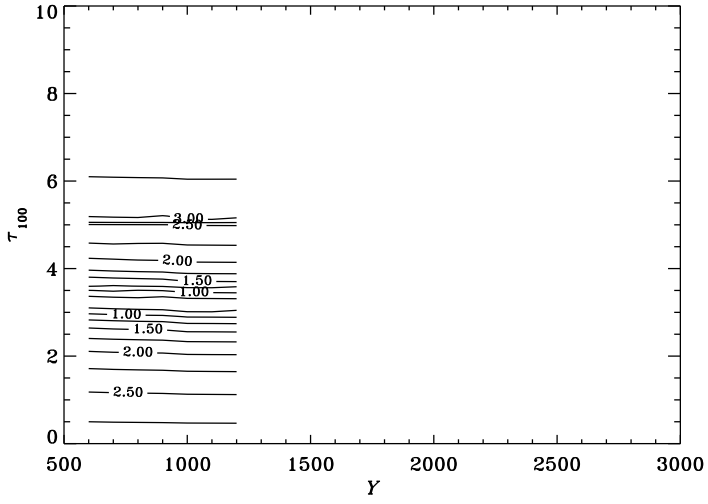

Figure 2.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

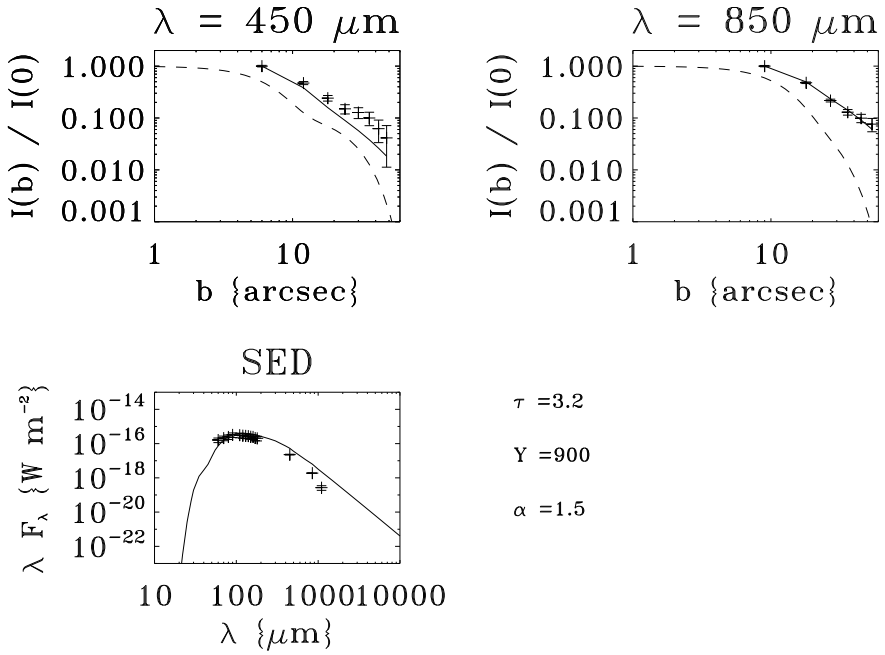

Figure 2.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

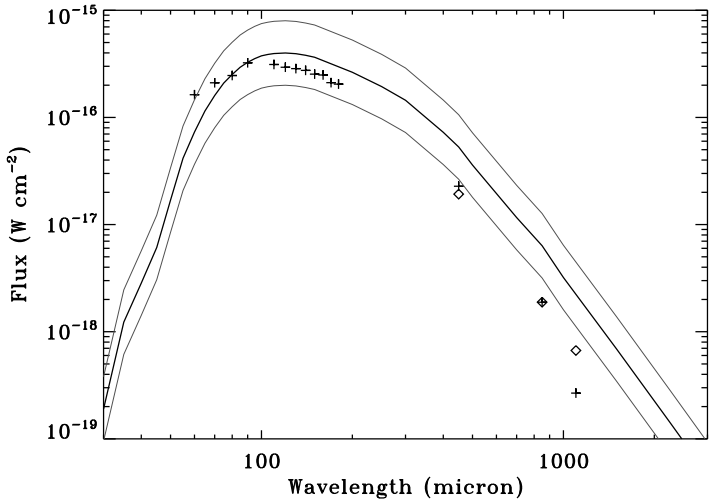

Figure 2.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 3

NGC1333 IRAS2A

3.1 Input data: radial profile, luminosity and SED

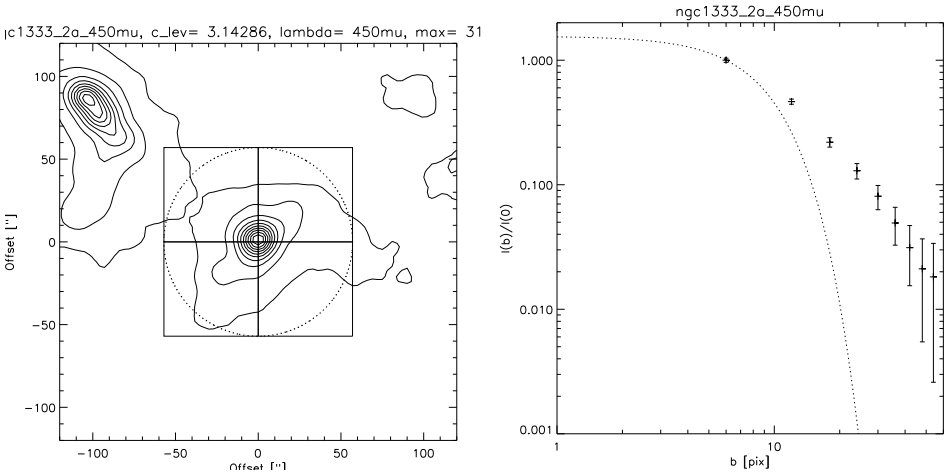

Figure 3.1: Map and radial emission profile of NGC1333 IRAS2A at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
ngc1333_2a
==========================
Luminosity =      35.7000
Distance =      235.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

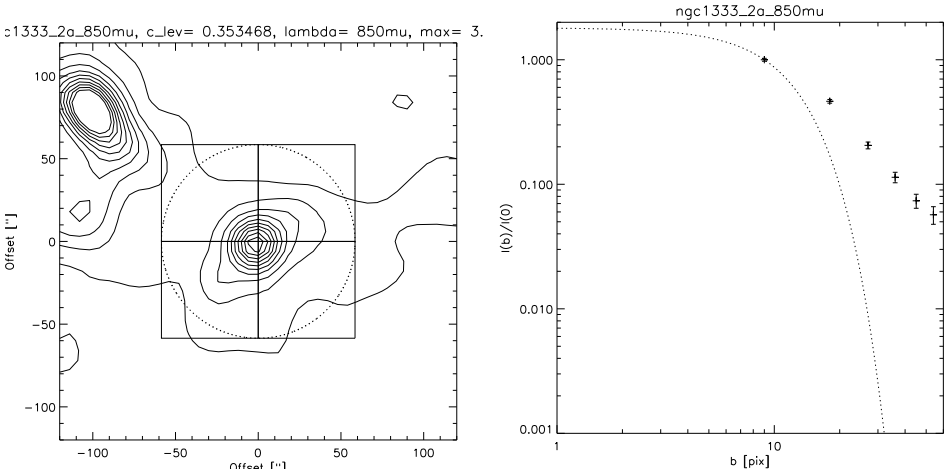

Figure 3.2: Map and radial emission profile of NGC1333 IRAS2A at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.63734800
       18.000000       0.32052000
       24.000000       0.17725900
       30.000000       0.12373500
       36.000000      0.071353800
       42.000000      0.044284400
       48.000000      0.031638600
       54.000000      0.020834600

850 mu:
       9.0000000        1.0000000
       18.000000       0.49028900
       27.000000       0.22428800
       36.000000       0.12221100
       45.000000      0.068109600
       54.000000      0.052345000

SED:
       60.017600   1.0227000e-15
       70.004300   1.3100624e-15
       80.011100   1.4930429e-15
       90.029300   1.5348337e-15
```

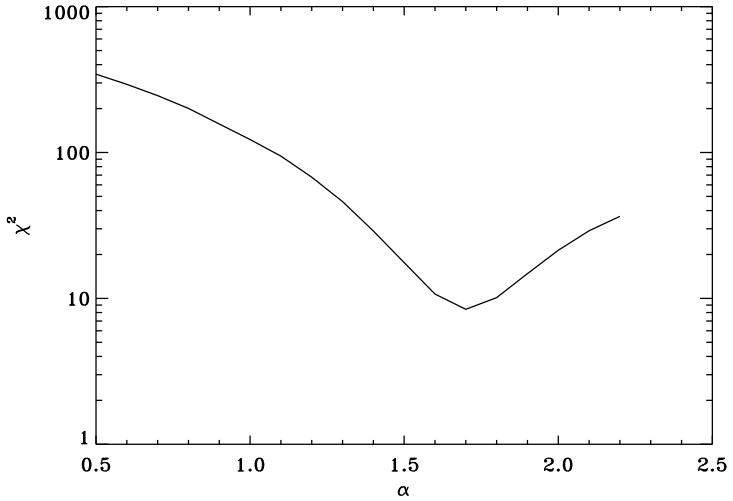

Figure 3.3: Reduced χ^2 as a function of the power-law density slope, α.

```
100.00630   1.3838129e-15
110.00410   1.1533207e-15
120.00950   1.0361680e-15
130.06000   9.3764420e-16
140.00470   8.6354247e-16
150.04270   8.2036650e-16
160.04220   7.3799288e-16
170.02370   6.3996963e-16
180.04630   5.3719517e-16
450.00000   2.0960001e-17
850.00000   1.2458824e-18
1100.0000   3.3272729e-19
```

All SED points are in units of W m^{-2}.

3.2 χ^2 results

3.2.1 DUSTY parameters

3.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
               r1 [AU] =     35.87
           r(10K) [AU] =  1.69e+04
             ni [cm-3] =  4.89e+08
      n(1000 AU) [cm-3] =  1.71e+06
         n(10 K) [cm-3] =  1.40e+04
```

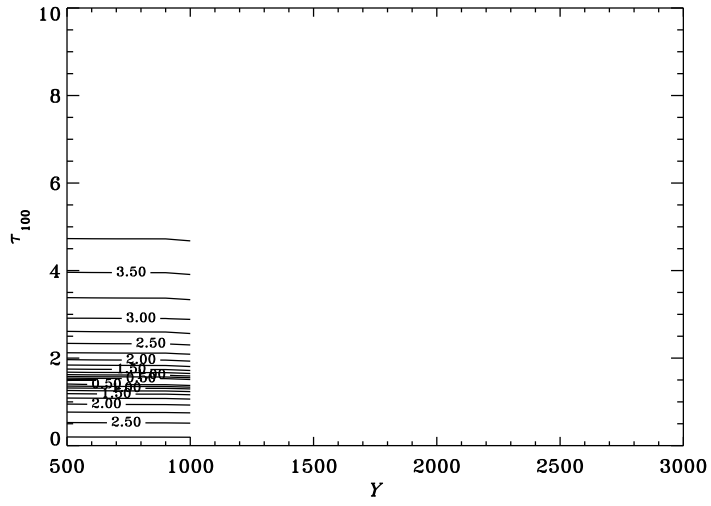

Figure 3.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

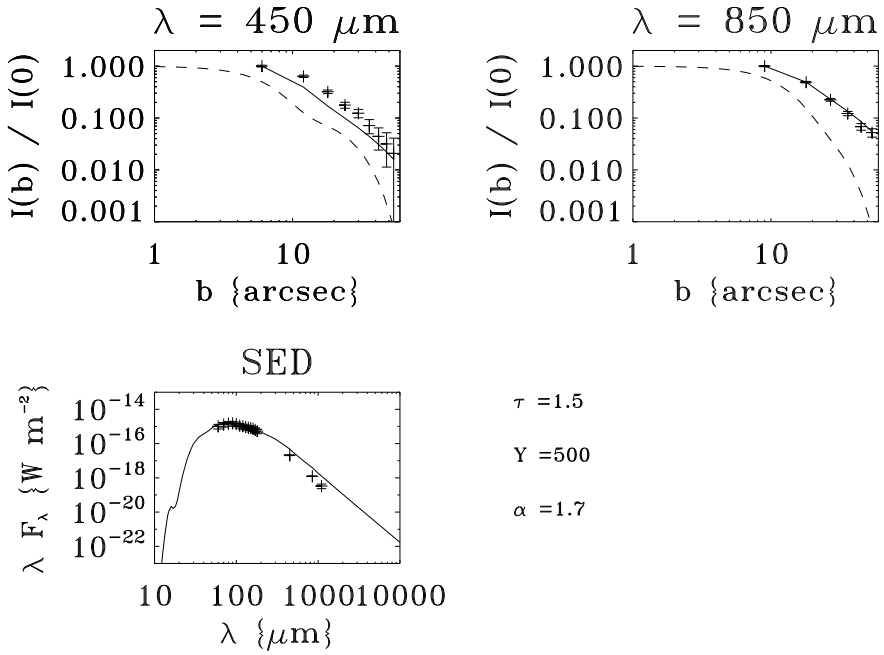

Figure 3.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

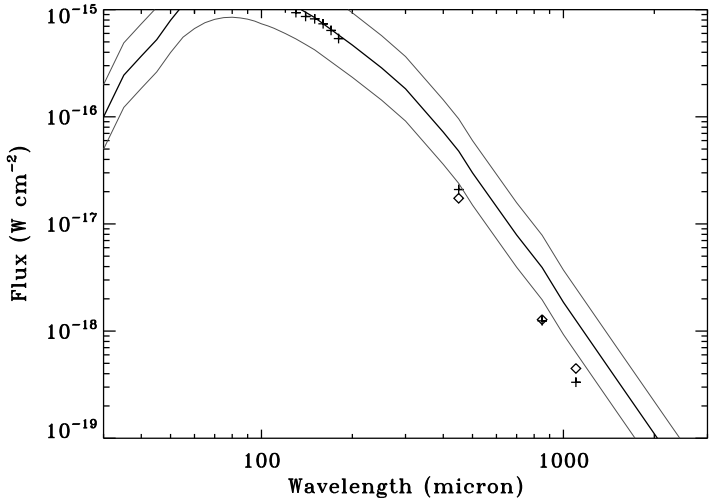

Figure 3.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

```
     N(H2)(10 K) [cm-2] =  3.70e+23
Envelope mass(10K) [MS] =     5.129
```

Chapter 4

NGC1333 IRAS4A

4.1 Input data: radial profile, luminosity and SED

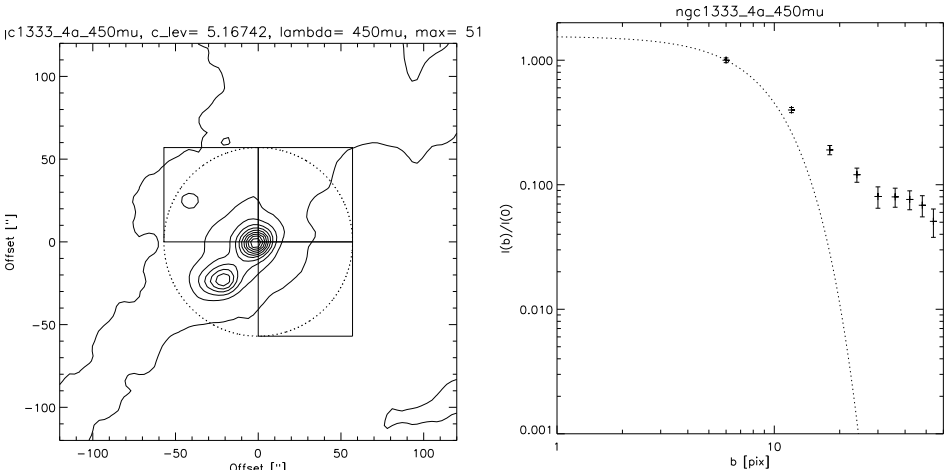

Figure 4.1: Map and radial emission profile of NGC1333 IRAS4A at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
ngc1333_4a
=========================
Luminosity =      9.10000
Distance =      235.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

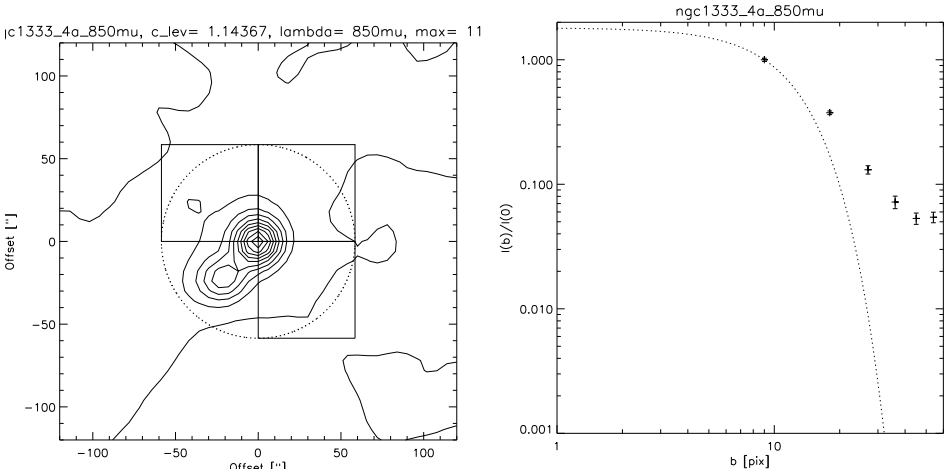

Figure 4.2: Map and radial emission profile of NGC1333 IRAS4A at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.44492700
       18.000000       0.20517400
       24.000000       0.12463000
       30.000000      0.080926400

850 mu:
       9.0000000        1.0000000
       18.000000       0.37526100
       27.000000       0.13085100
       36.000000      0.072013000
       45.000000      0.053186800

SED:
       69.300000   1.4536797e-16
       87.190000   2.6981765e-16
       108.07000   4.3516241e-16
       118.58100   4.5106132e-16
       138.52800   4.4572940e-16
       157.70000   4.1870452e-16
       179.52700   3.3052523e-16
       450.00000   3.4453335e-17
       850.00000   4.0411766e-18
```

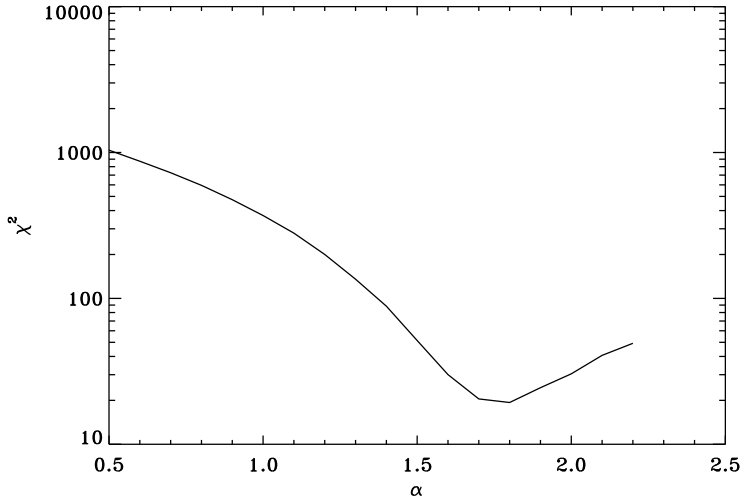

Figure 4.3: Reduced χ^2 as a function of the power-law density slope, α.

```
    1100.0000    1.4863637e-18
```

All SED points are in units of W m^{-2}.

4.2 χ^2 results

4.2.1 DUSTY parameters

4.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
               r1 [AU] =     33.47
           r(10K) [AU] =  6.85e+03
             ni [cm-3] =  3.05e+09
      n(1000 AU) [cm-3] =  6.74e+06
         n(10 K) [cm-3] =  2.11e+05
     N(H2)(10 K) [cm-2] =  1.88e+24
Envelope mass(10K) [MS] =     5.592
```

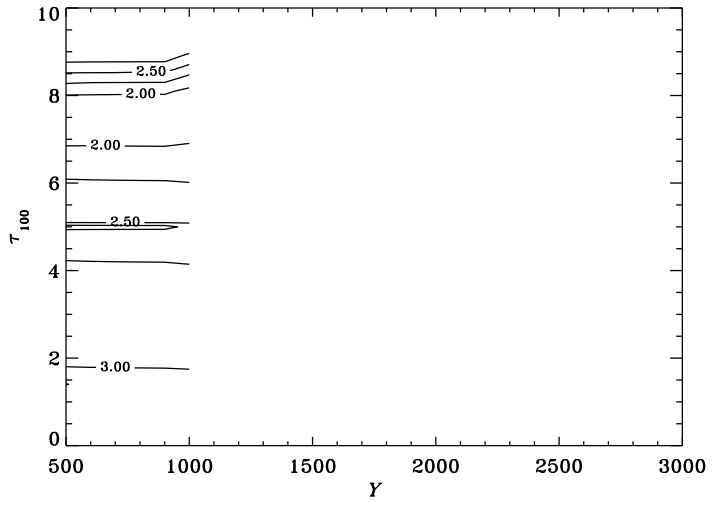

Figure 4.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

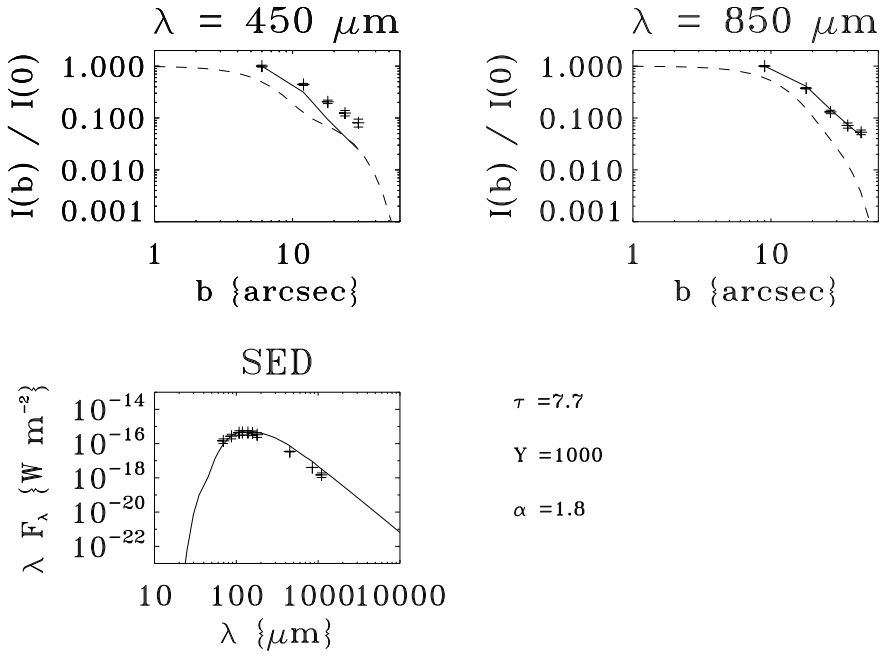

Figure 4.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

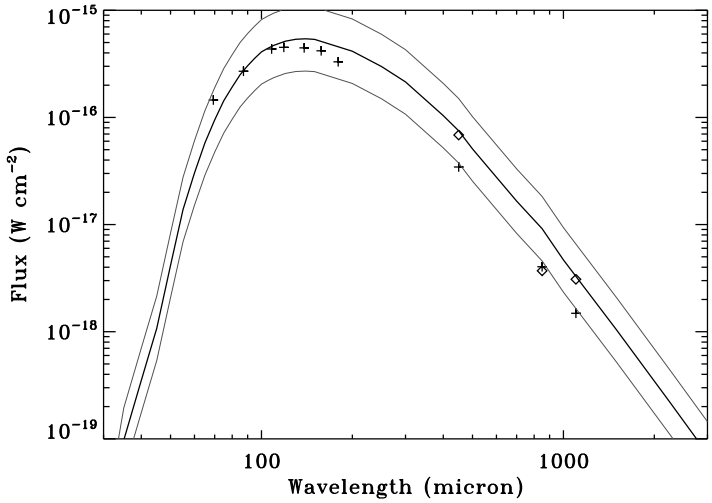

Figure 4.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 5

NGC1333 IRAS4B

5.1 Input data: radial profile, luminosity and SED

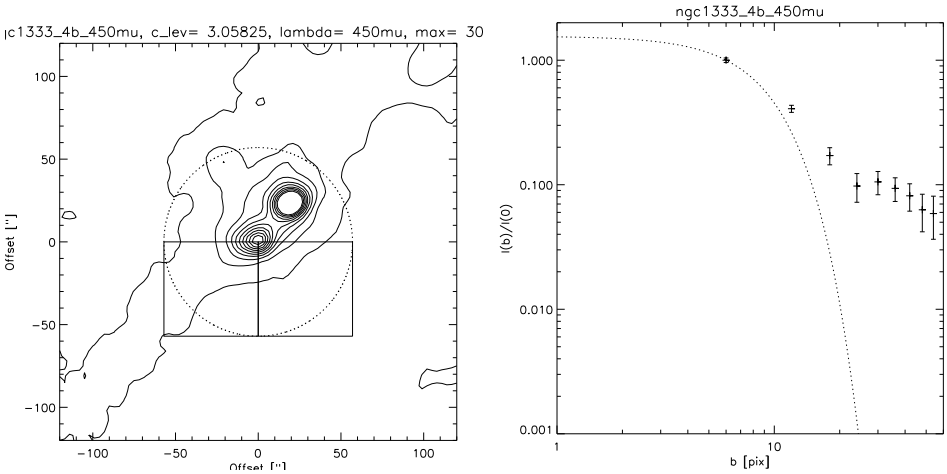

Figure 5.1: Map and radial emission profile of NGC1333 IRAS4B at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
ngc1333_4b
==========================
Luminosity =      4.40000
Distance =      235.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

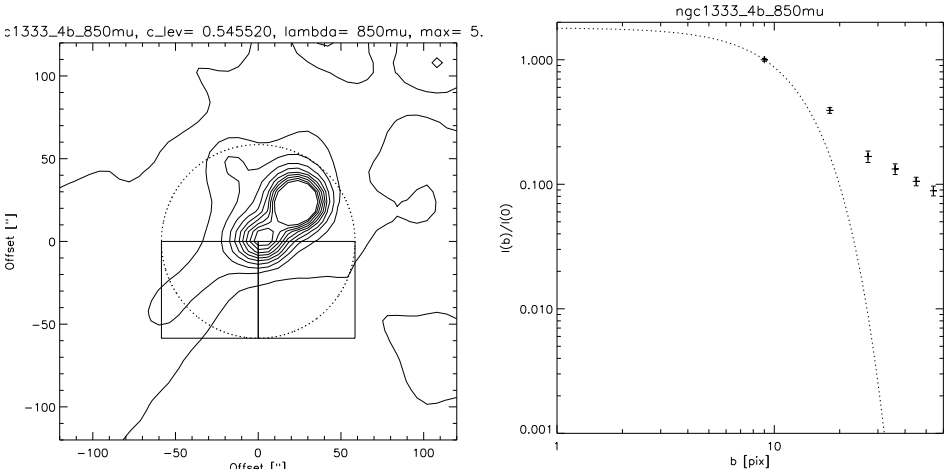

Figure 5.2: Map and radial emission profile of NGC1333 IRAS4B at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.44114400
       18.000000       0.17853200
       24.000000       0.12274800

850 mu:
       9.0000000        1.0000000
       18.000000       0.39202500
       27.000000       0.16727600
       36.000000       0.13281500
       45.000000       0.10557700
       54.000000      0.088719300

SED:
       69.300000   5.7805197e-17
       89.990000   1.2482387e-16
       118.58100   2.3471805e-16
       138.52800   2.3821250e-16
       157.70000   2.2991187e-16
       179.52700   1.9431395e-16
       450.00000   2.0400001e-17
       850.00000   1.9270589e-18
       1300.0000   3.3923078e-19
```

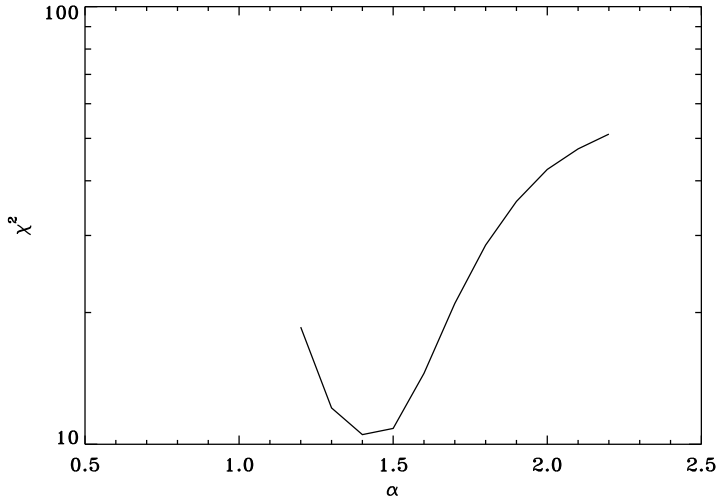

Figure 5.3: Reduced χ^2 as a function of the power-law density slope, α.

All SED points are in units of W m^{-2}.

5.2 χ^2 results

5.2.1 DUSTY parameters

5.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
                r1 [AU] =     15.00
            r(10K) [AU] =  3.82e+03
              ni [cm-3] =  2.03e+09
      n(1000 AU) [cm-3] =  5.68e+06
         n(10 K) [cm-3] =  8.69e+05
     N(H2)(10 K) [cm-2] =  1.02e+24
Envelope mass(10K) [MS] =     3.007
```

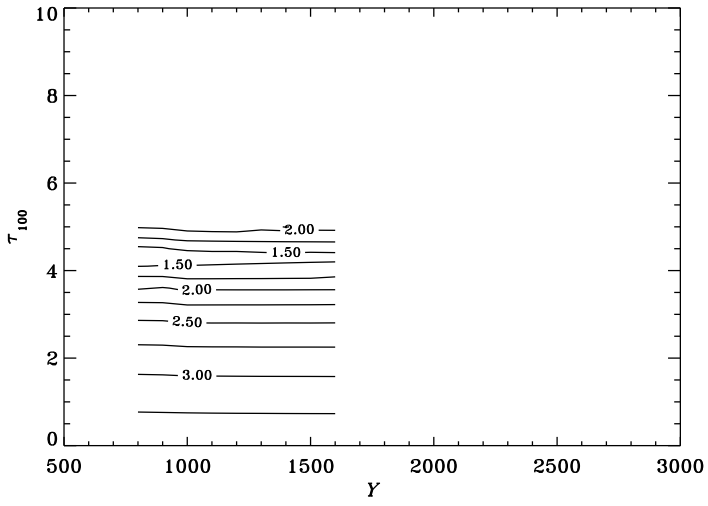

Figure 5.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

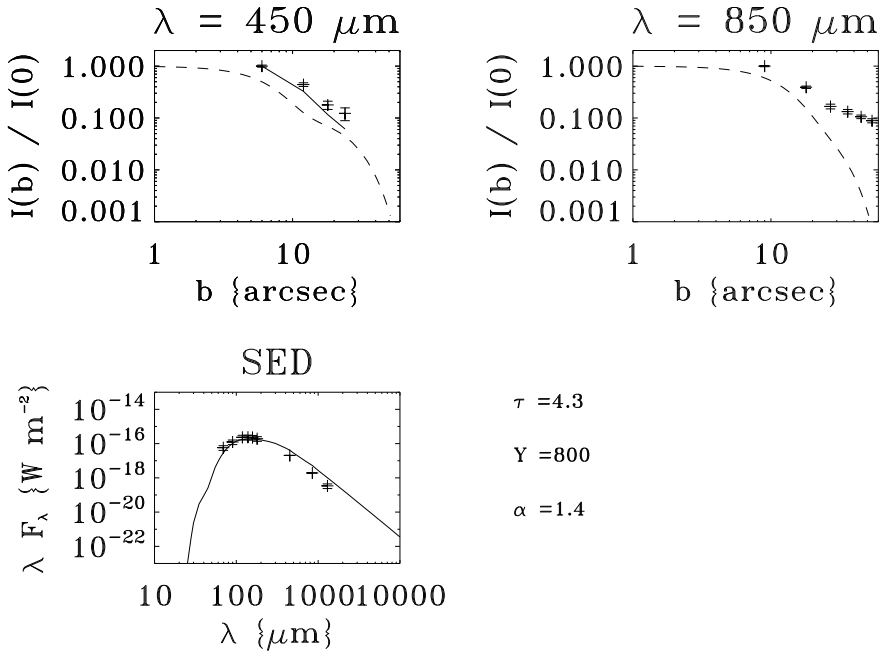

Figure 5.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

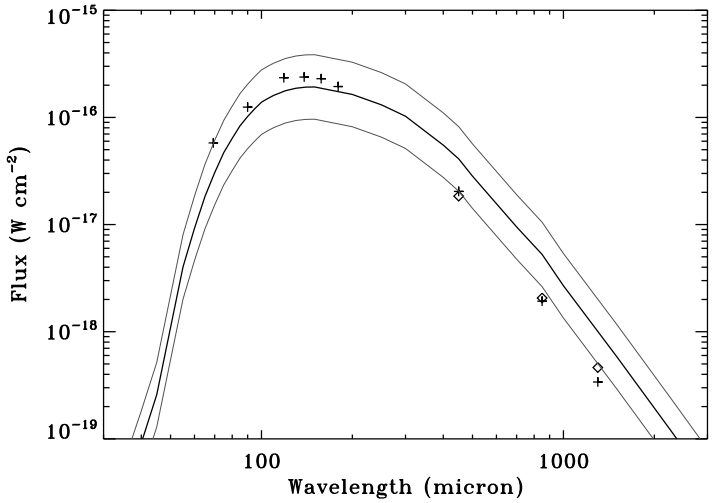

Figure 5.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 6

L1527

6.1 Input data: radial profile, luminosity and SED

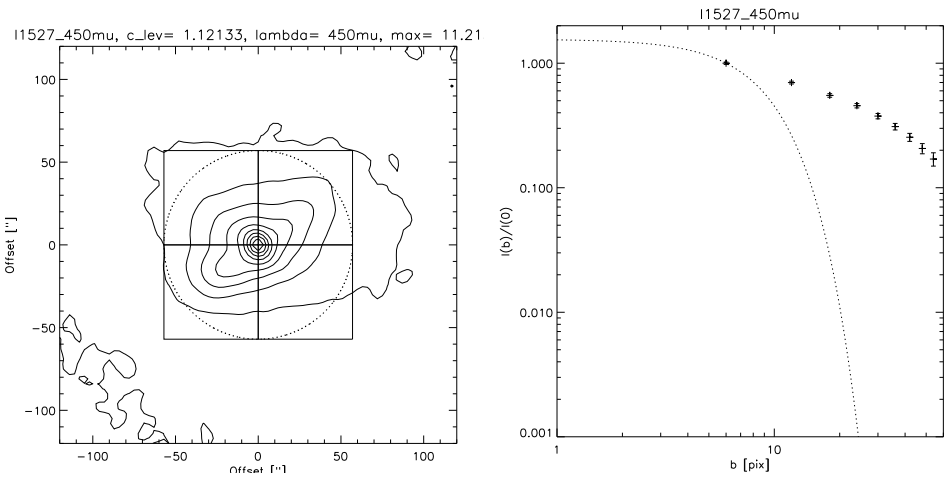

Figure 6.1: Map and radial emission profile of L1527 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
l1527
=========================
Luminosity =      1.85000
Distance =      140.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

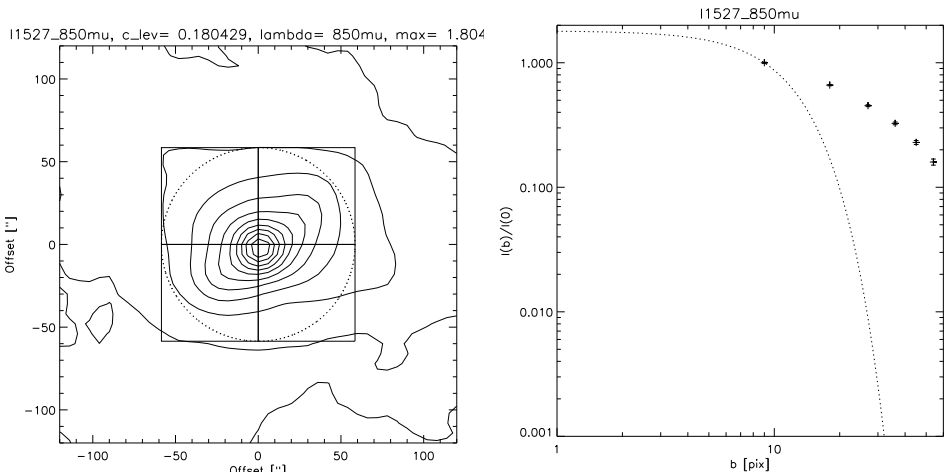

Figure 6.2: Map and radial emission profile of L1527 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.71761700
       18.000000       0.56568700
       24.000000       0.46526400
       30.000000       0.38074200
       36.000000       0.31032000
       42.000000       0.25336300
       48.000000       0.20618600
       54.000000       0.16989600

850 mu:
       9.0000000        1.0000000
       18.000000       0.66146000
       27.000000       0.45211100
       36.000000       0.32597800
       45.000000       0.22926700
       54.000000       0.15956800

SED:
       69.300000   1.3554113e-16
       89.990000   1.6986888e-16
       108.76000   2.1911917e-16
       118.58100   2.4612544e-16
```

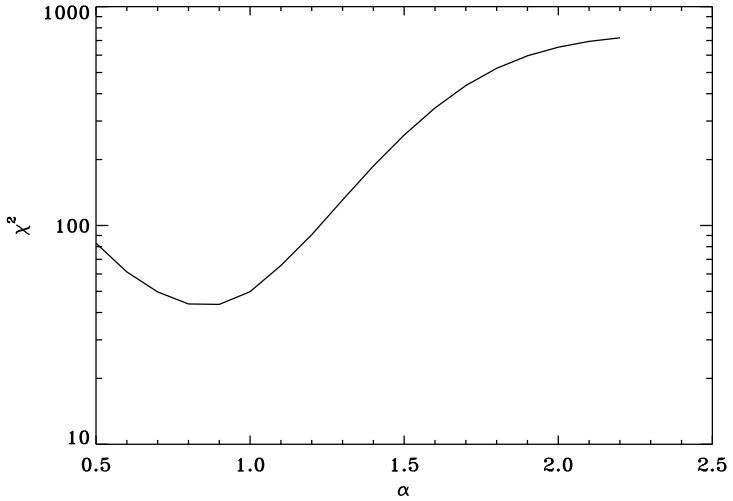

Figure 6.3: Reduced χ^2 as a function of the power-law density slope, α.

```
138.52800   2.3011305e-16
157.70000   2.0341028e-16
179.52700   1.4780173e-16
450.00000   7.4666669e-18
850.00000   6.3882355e-19
1300.0000   1.6615385e-19
```

All SED points are in units of W m^{-2}.

6.2 χ^2 results

6.2.1 DUSTY parameters

6.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
                r1 [AU] =      5.41
           r(10K) [AU] =  4.56e+03
             ni [cm-3] =  8.86e+07
      n(1000 AU) [cm-3] =  8.08e+05
         n(10 K) [cm-3] =  2.06e+05
     N(H2)(10 K) [cm-2] =  6.90e+22
Envelope mass(10K) [MS] =     0.923
```

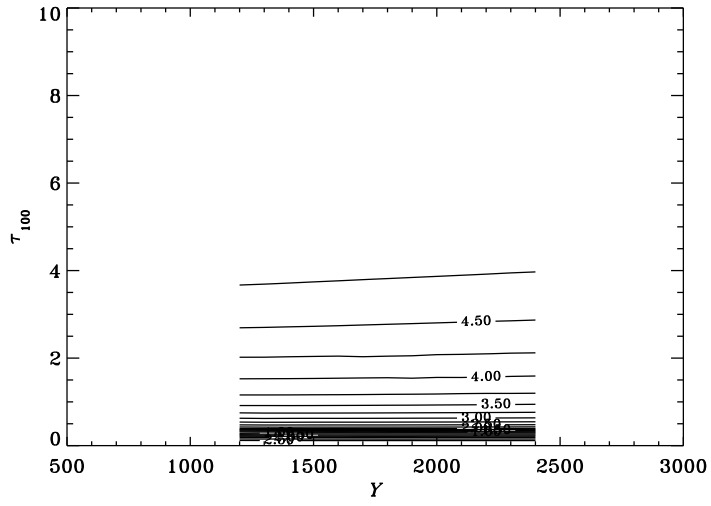

Figure 6.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

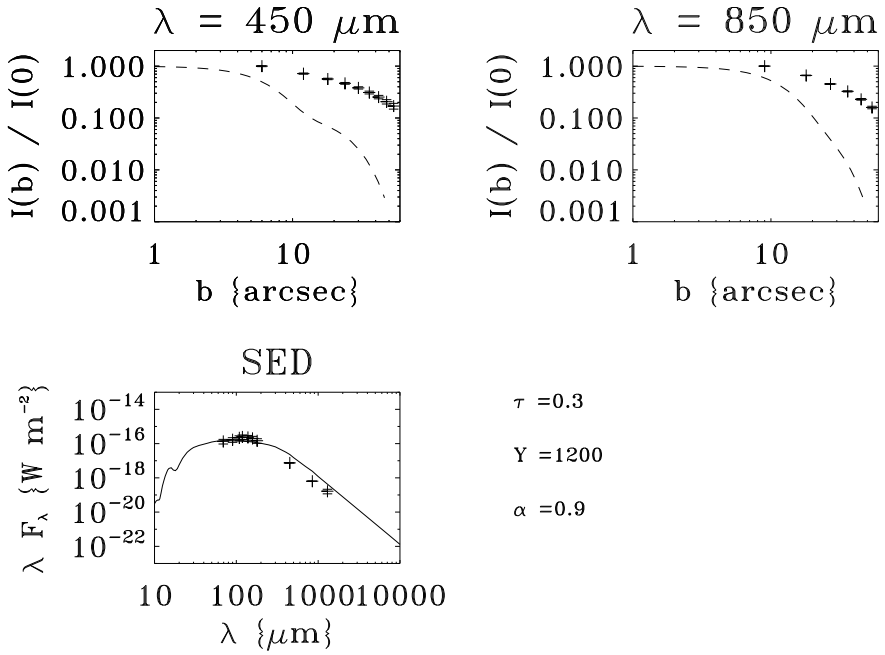

Figure 6.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

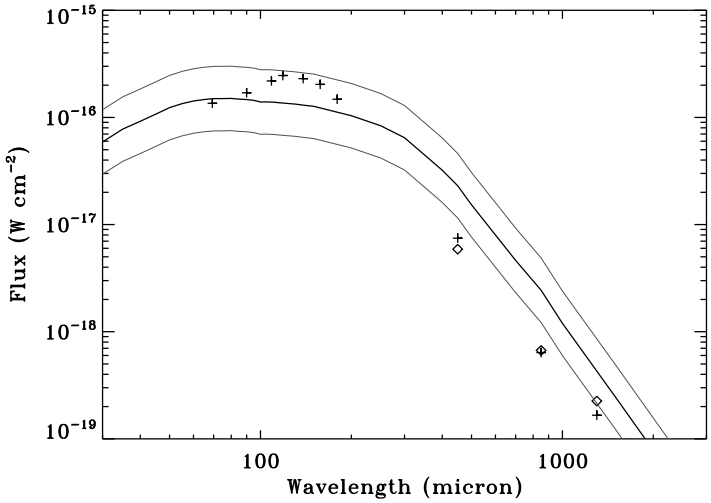

Figure 6.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 7

Ced110-IRS4

7.1 Input data: radial profile, luminosity and SED

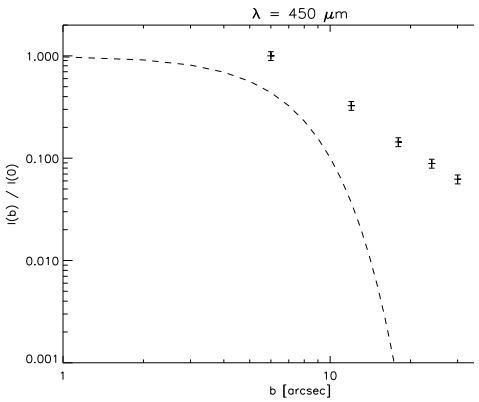

Figure 7.1: Map and radial emission profile of Ced110-IRS4 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
ced110_irs4
=========================
Luminosity =     0.800000
Distance =      125.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

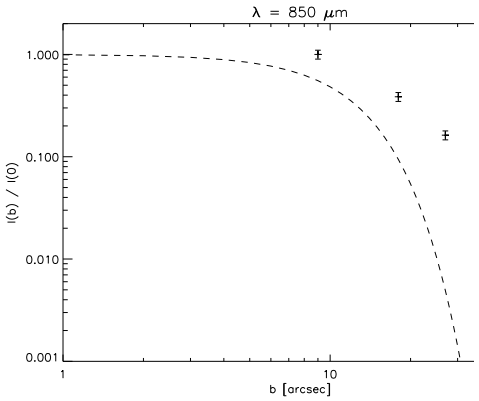

Figure 7.2: Map and radial emission profile of Ced110-IRS4 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
      6.00000      1.00000
      12.0000     0.374156
      18.0000     0.176061
      24.0000     0.111452
      30.0000    0.0784836
      36.0000    0.0582585
      42.0000    0.0448034
      48.0000    0.0352373
      54.0000    0.0271767

850 mu:
      9.00000      1.00000
      18.0000     0.434472
      27.0000     0.195712
      36.0000     0.114433
      45.0000    0.0755125
      54.0000    0.0454798

SED:
       89.990000   6.4143796e-17
       108.07000   1.0454891e-16
       118.58100   1.0489792e-16
       138.52800   1.0305787e-16
```

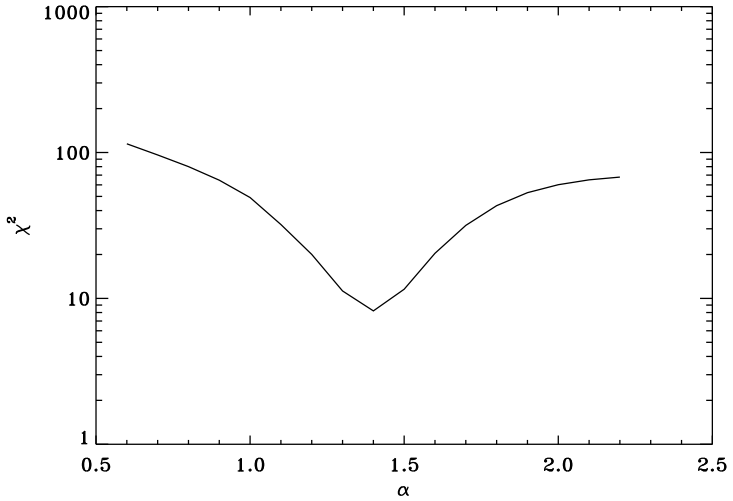

Figure 7.3: Reduced χ^2 as a function of the power-law density slope, α.

```
157.70000   9.6091316e-17
179.52700   7.1447751e-17
850.00000   2.1423530e-19
1300.0000   4.8230771e-20
```

All SED points are in units of W m^{-2}.

7.2 χ^2 results

7.2.1 DUSTY parameters

7.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
                r1 [AU] =      4.13
            r(10K) [AU] =  3.37e+03
              ni [cm-3] =  8.45e+08
      n(1000 AU) [cm-3] =  3.89e+05
         n(10 K) [cm-3] =  7.08e+04
     N(H2)(10 K) [cm-2] =  1.22e+23
Envelope mass(10K) [MS] =     0.168
```

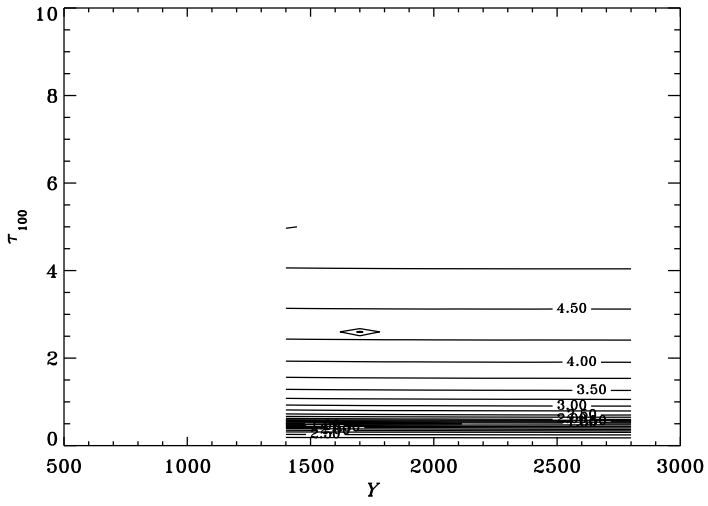

Figure 7.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

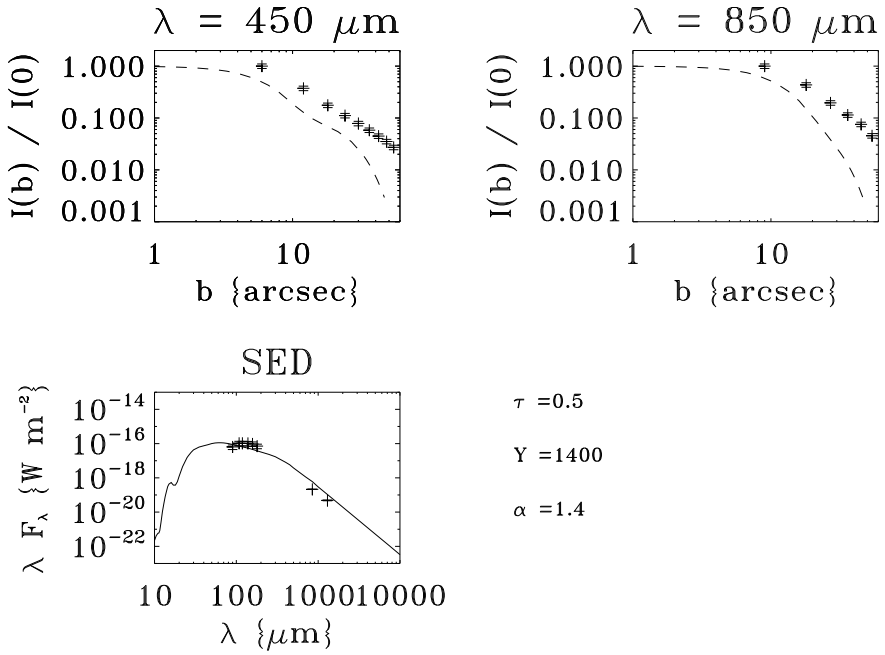

Figure 7.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

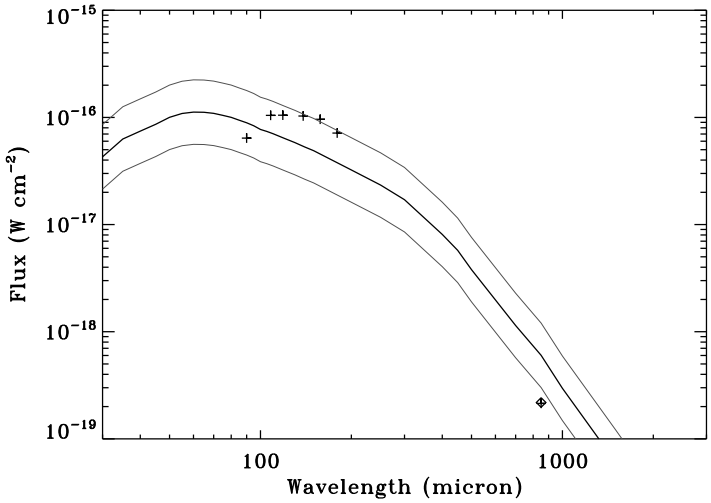

Figure 7.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 8

BHR71

8.1 Input data: radial profile, luminosity and SED

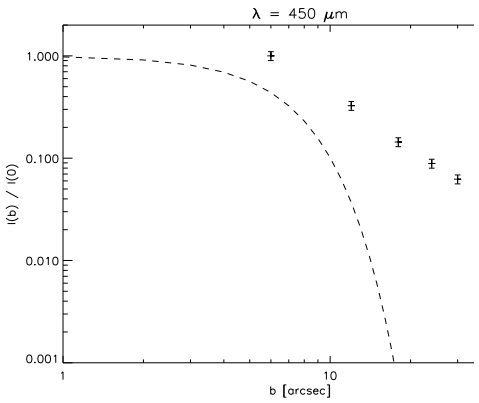

Figure 8.1: Map and radial emission profile of BHR71 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
bhr71
=========================
Luminosity =      14.8000
Distance =      200.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

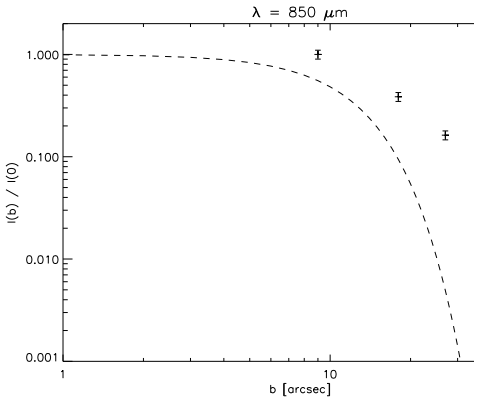

Figure 8.2: Map and radial emission profile of BHR71 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
      6.00000      1.00000
      12.0000     0.374156
      18.0000     0.176061
      24.0000     0.111452
      30.0000    0.0784836
      36.0000    0.0582585
      42.0000    0.0448034
      48.0000    0.0352373
      54.0000    0.0271767

850 mu:
      9.00000      1.00000
      18.0000     0.434472
      27.0000     0.195712
      36.0000     0.114433
      45.0000    0.0755125
      54.0000    0.0454798

SED:
       72.843000   5.1644086e-16
       108.07000   8.3736008e-16
       145.52500   6.7256694e-16
       1300.0000   3.9230771e-19
```

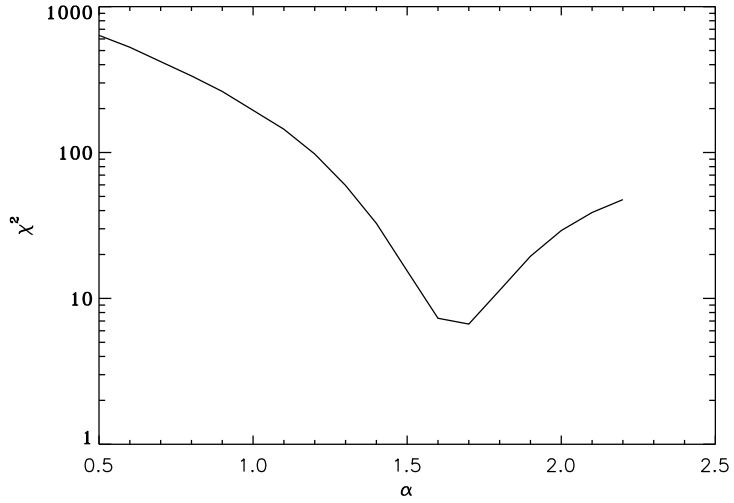

Figure 8.3: Reduced χ^2 as a function of the power-law density slope, α.

```
   3000.0000    1.4000001e-20
```

All SED points are in units of W m^{-2}.

8.2 χ^2 results

8.2.1 DUSTY parameters

8.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
               r1 [AU] =     24.84
           r(10K) [AU] =  9.94e+03
             ni [cm-3] =  9.42e+08
      n(1000 AU) [cm-3] =  1.76e+06
         n(10 K) [cm-3] =  3.55e+04
     N(H2)(10 K) [cm-2] =  4.92e+23
Envelope mass(10K) [MS] =     2.657
```

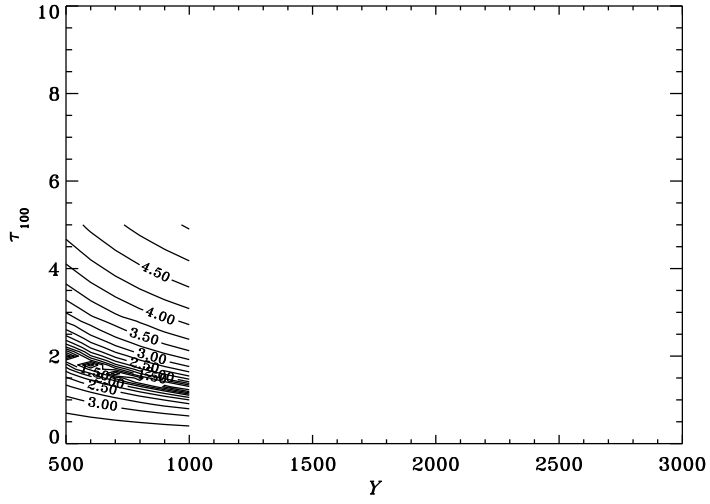

Figure 8.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

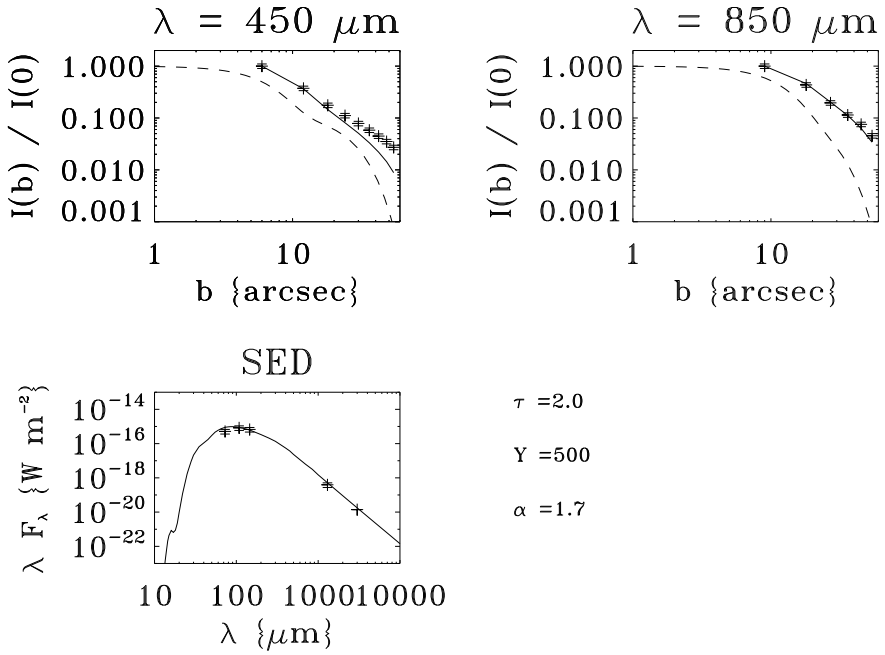

Figure 8.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

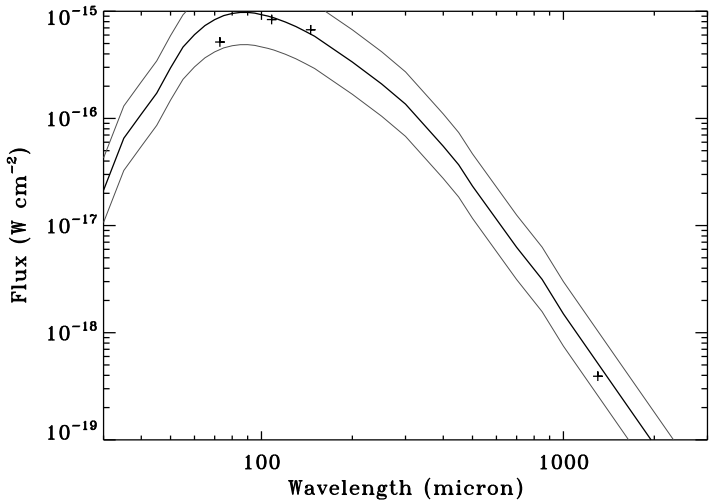

Figure 8.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 9

IRAS15398

9.1 Input data: radial profile, luminosity and SED

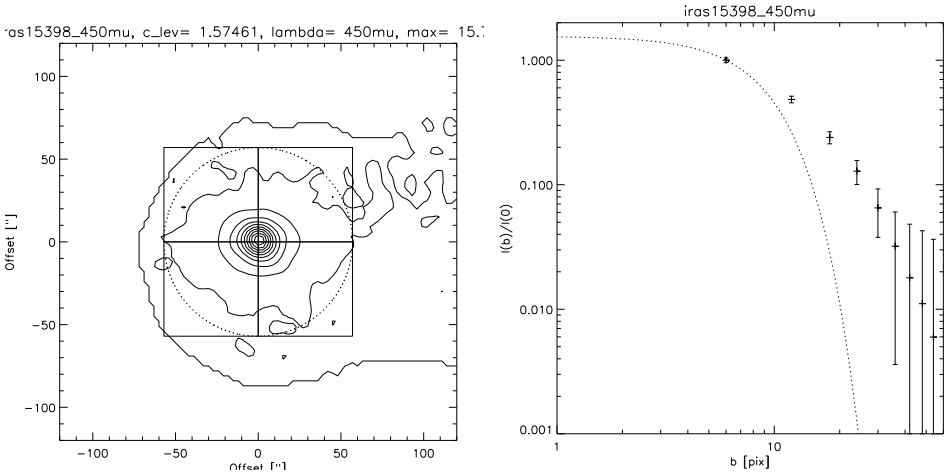

Figure 9.1: Map and radial emission profile of IRAS15398 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
iras15398
=========================
Luminosity =      1.20000
Distance =      150.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

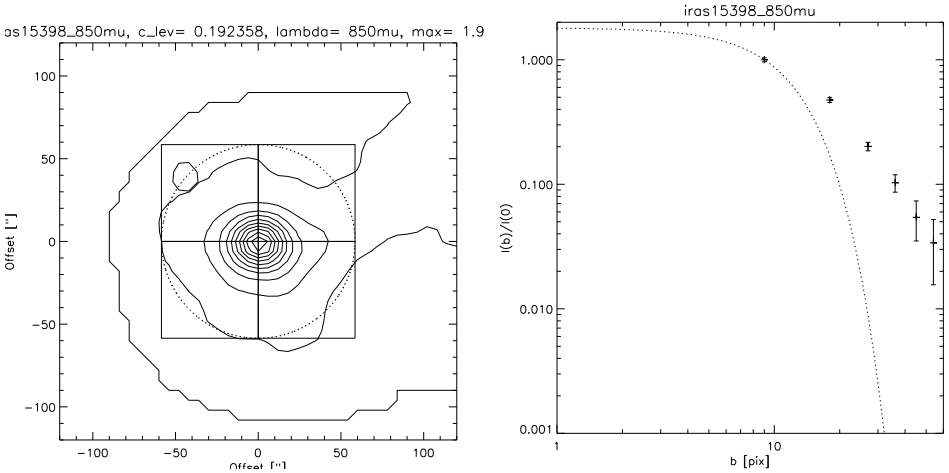

Figure 9.2: Map and radial emission profile of IRAS15398 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.50476300
       18.000000       0.24938200
       24.000000       0.13228700
       30.000000      0.068329200
       36.000000      0.033675800
       42.000000      0.019007400
       48.000000      0.012493300
       54.000000     0.0055237000

850 mu:
       9.0000000        1.0000000
       18.000000       0.51553100
       27.000000       0.22640700
       36.000000       0.11365900
       45.000000      0.061490000
       54.000000      0.035102400

SED:
       69.300000   9.1857146e-17
       89.990000   8.8826540e-17
       108.07000   1.4958916e-16
       118.58100   1.4930048e-16
```

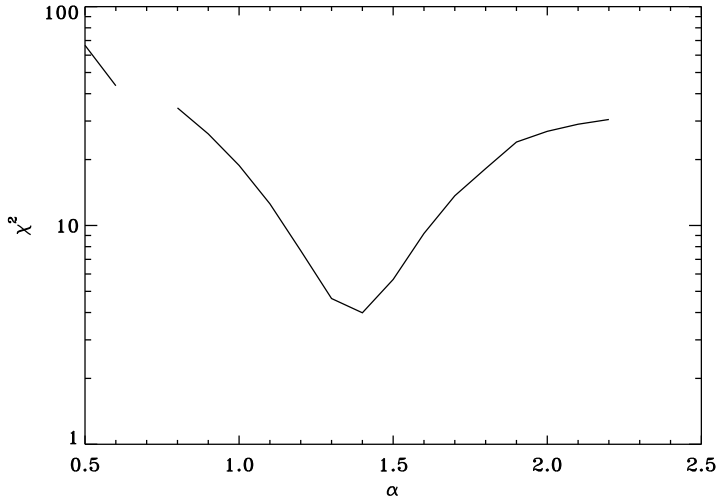

Figure 9.3: Reduced χ^2 as a function of the power-law density slope, α.

```
138.52800   1.4230337e-16
179.52700   1.0642132e-16
450.00000   1.0500000e-17
850.00000   6.8117650e-19
1300.0000   8.4230772e-20
```

All SED points are in units of W m^{-2}.

9.2 χ^2 results

9.2.1 DUSTY parameters

9.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
               r1 [AU] =      6.17
           r(10K) [AU] =  2.67e+03
             ni [cm-3] =  1.94e+09
      n(1000 AU) [cm-3] =  1.56e+06
         n(10 K) [cm-3] =  3.95e+05
     N(H2)(10 K) [cm-2] =  4.08e+23
Envelope mass(10K) [MS] =     0.467
```

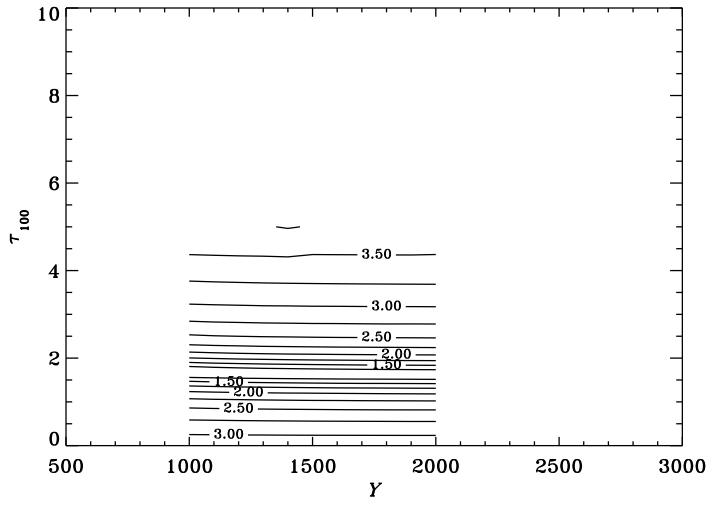

Figure 9.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

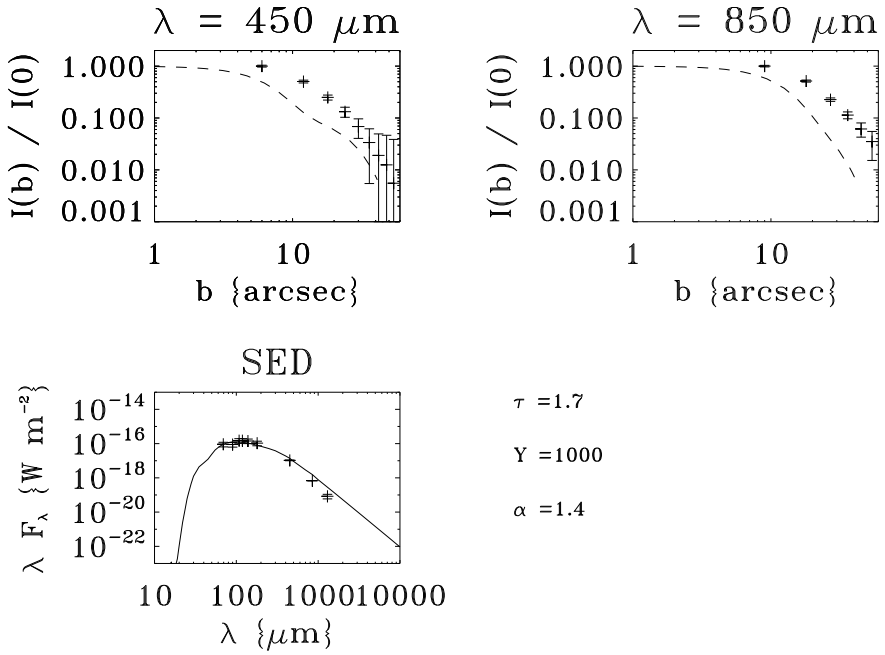

Figure 9.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

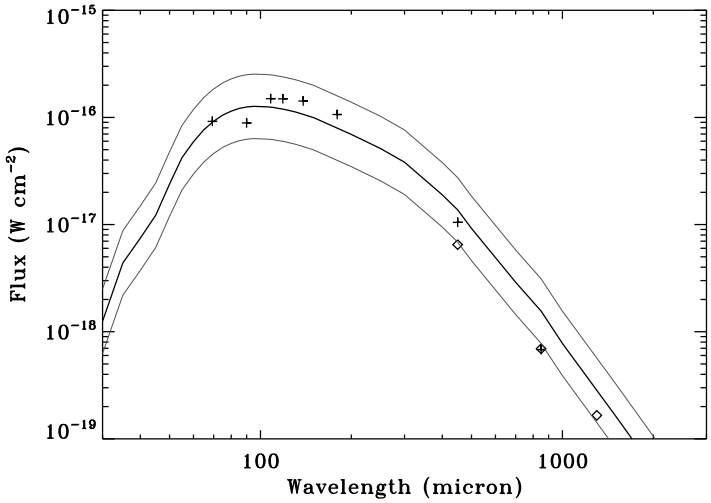

Figure 9.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 10

L483

10.1 Input data: radial profile, luminosity and SED

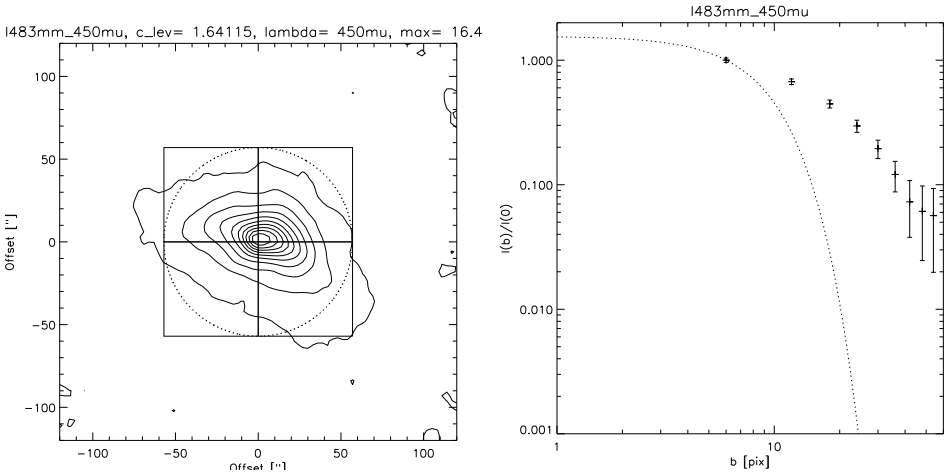

Figure 10.1: Map and radial emission profile of L483 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
l483mm
========================
Luminosity =      10.2000
Distance =      200.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

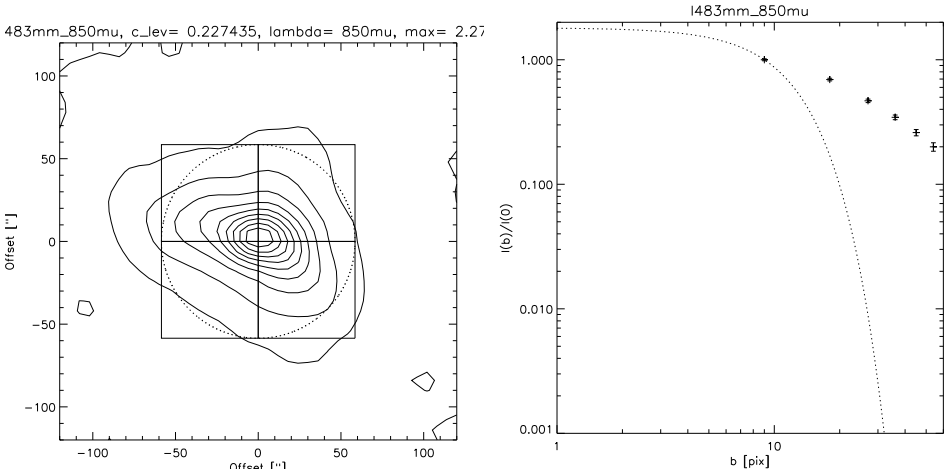

Figure 10.2: Map and radial emission profile of L483 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.72193900
       18.000000       0.47943400
       24.000000       0.31306600
       30.000000       0.20390600
       36.000000       0.12996400
       42.000000      0.081341900
       48.000000      0.060135500
       54.000000      0.060259100

850 mu:
       9.0000000        1.0000000
       18.000000       0.69340300
       27.000000       0.46804700
       36.000000       0.34507900
       45.000000       0.26014700
       54.000000       0.19986500

SED:
       69.300000   3.2922512e-16
       89.990000   3.7551174e-16
       108.07000   5.7092442e-16
       118.58100   4.1812434e-16
```

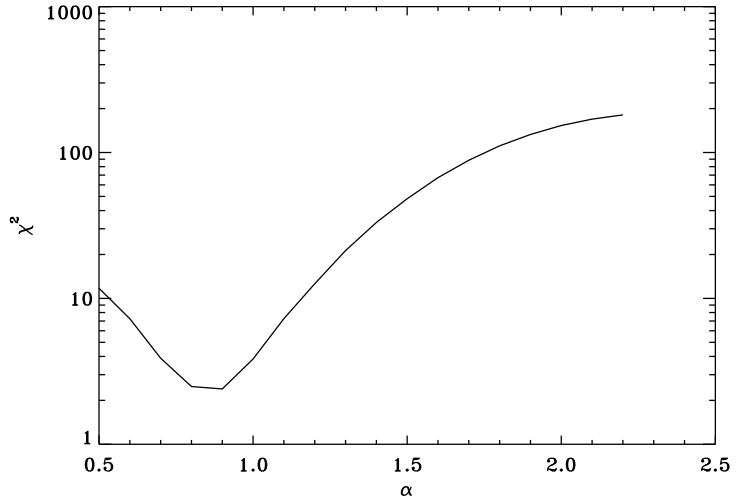

Figure 10.3: Reduced χ^2 as a function of the power-law density slope, α.

```
138.52800   3.6449022e-16
157.70000   3.1099938e-16
179.52700   2.3160528e-16
450.00000   1.0940000e-17
850.00000   8.0117650e-19
1100.0000   1.7454546e-19
```

All SED points are in units of W m^{-2}.

10.2 χ^2 results

10.2.1 DUSTY parameters

10.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
                r1 [AU] =     12.49
            r(10K) [AU] =  1.19e+04
              ni [cm-3] =  2.65e+07
      n(1000 AU) [cm-3] =  5.14e+05
         n(10 K) [cm-3] =  5.53e+04
     N(H2)(10 K) [cm-2] =  4.89e+22
Envelope mass(10K) [MS] =     4.401
```

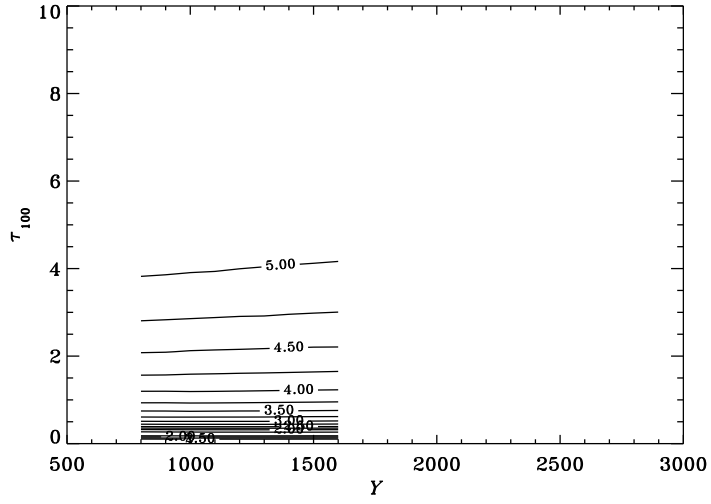

Figure 10.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

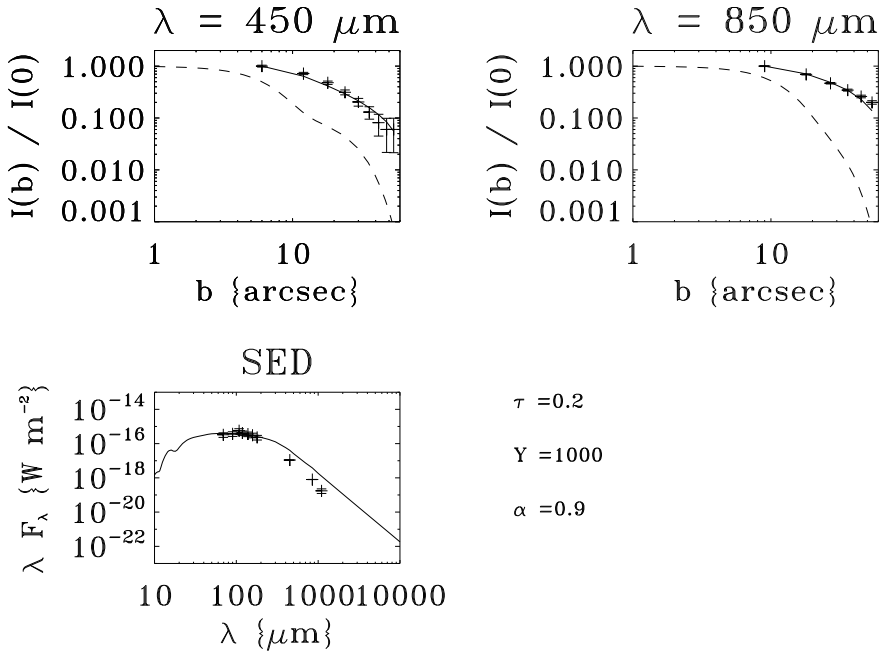

Figure 10.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

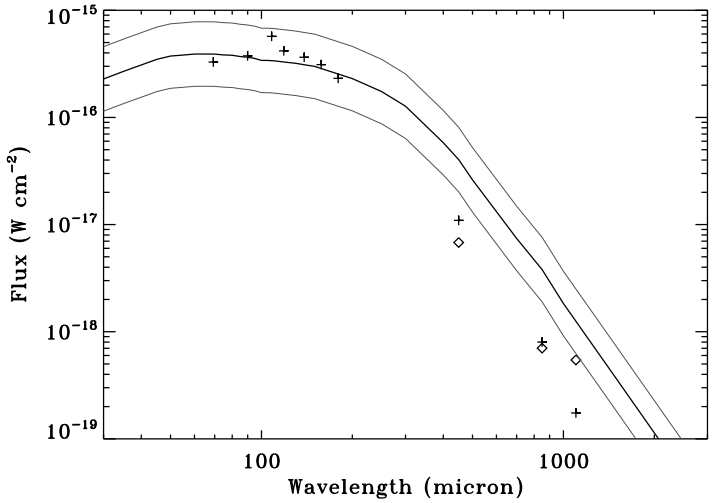

Figure 10.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 11

Ser-SMM1

11.1 Input data: radial profile, luminosity and SED

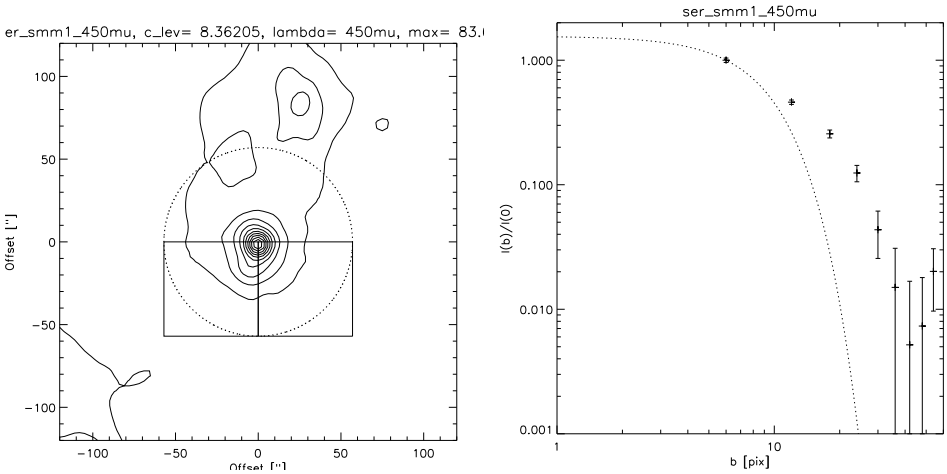

Figure 11.1: Map and radial emission profile of Ser-SMM1 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
ser_smm1
========================
Luminosity =      30.4000
Distance =      230.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

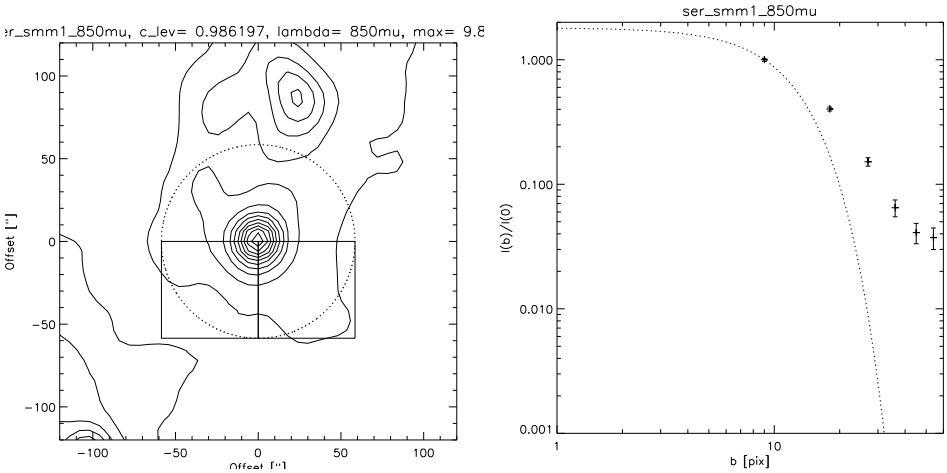

Figure 11.2: Map and radial emission profile of Ser-SMM1 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.81087600
       18.000000       0.63758500
       24.000000       0.33630000
       30.000000      0.083801000
       36.000000      0.011961300
       42.000000     0.0021769200
       48.000000    0.00066960900
       54.000000     0.0017849400

850 mu:
       9.0000000        1.0000000
       18.000000       0.67939900
       27.000000       0.36170800
       36.000000       0.19848600
       45.000000       0.11134200
       54.000000      0.075032700

SED:
       60.003200   6.6846437e-16
       70.007200   1.0036111e-15
       80.008300   1.2366217e-15
       90.002200   1.3896327e-15
```

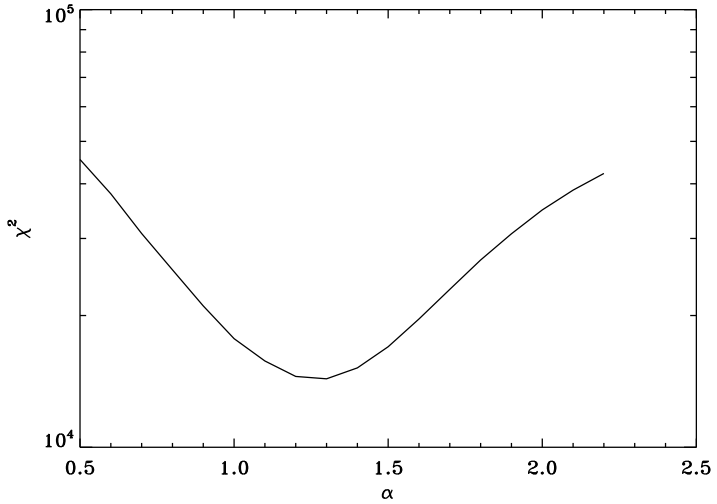

Figure 11.3: Reduced χ^2 as a function of the power-law density slope, α.

```
100.01420   1.4283972e-15
110.03650   1.5076816e-15
120.02160   1.4227440e-15
130.05760   1.3021154e-15
140.02670   1.2589028e-15
150.00230   1.1631822e-15
160.00160   1.0289897e-15
170.04590   8.9693433e-16
179.97950   7.3275015e-16
450.00000   5.5740002e-17
850.00000   3.4835295e-18
1100.0000   9.4636367e-19
```

All SED points are in units of W m^{-2}.

11.2 χ^2 results

11.2.1 DUSTY parameters

11.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
               r1 [AU] =     31.03
           r(10K) [AU] =  1.19e+04
             ni [cm-3] =  3.77e+08
      n(1000 AU) [cm-3] =  4.13e+06
         n(10 K) [cm-3] =  1.66e+05
```

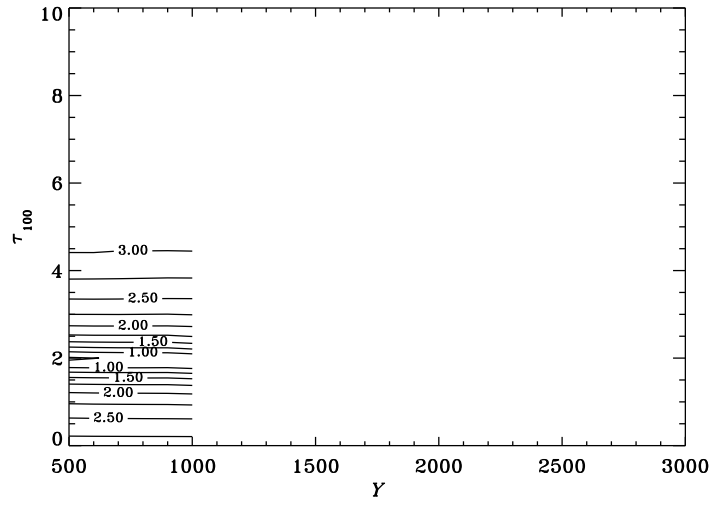

Figure 11.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

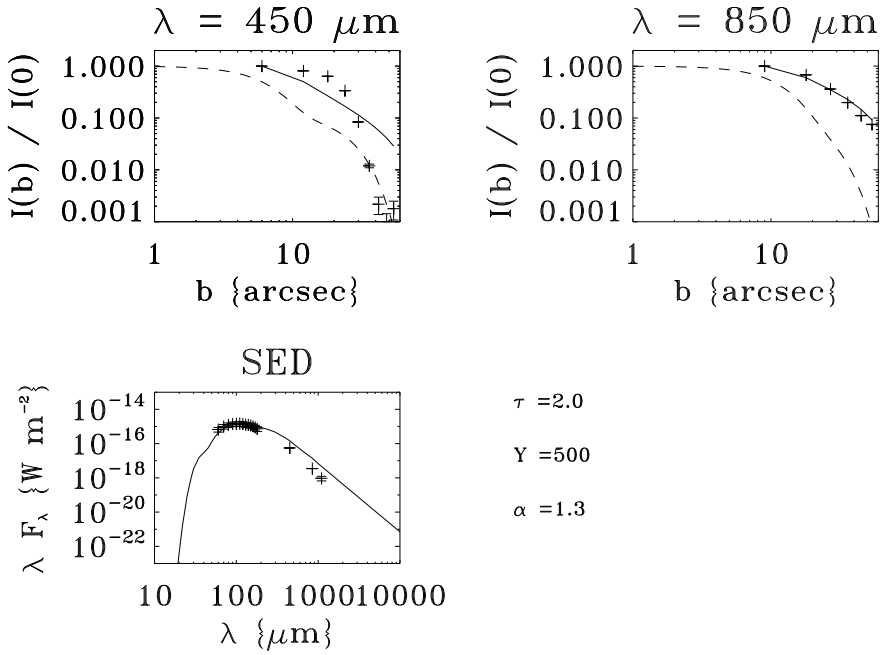

Figure 11.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

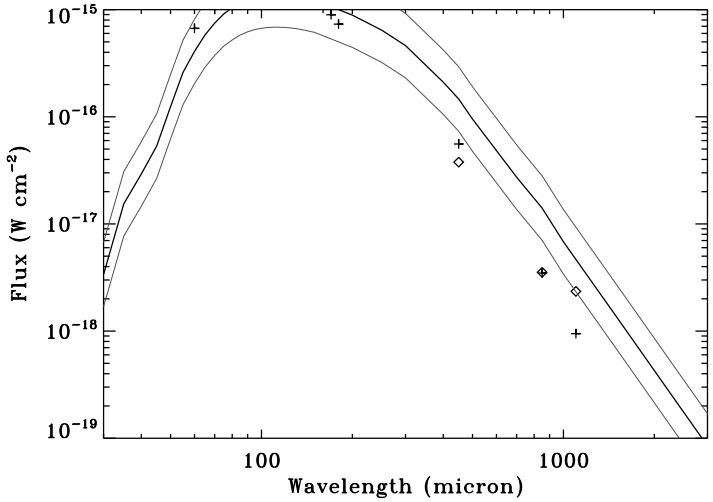

Figure 11.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

```
     N(H2)(10 K) [cm-2] =  4.86e+23
Envelope mass(10K) [MS] =    16.130
```

Chapter 12

Ser-SMM4

12.1 Input data: radial profile, luminosity and SED

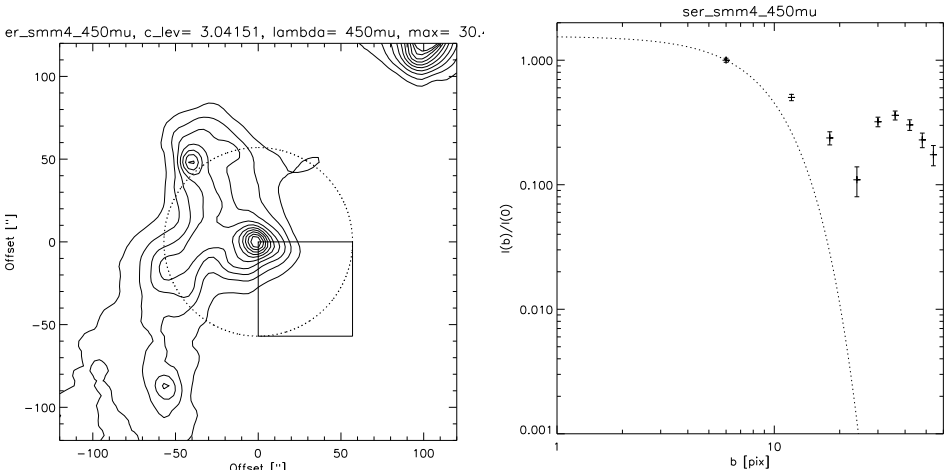

Figure 12.1: Map and radial emission profile of Ser-SMM4 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
ser_smm4
========================
Luminosity =      1.90000
Distance =      230.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

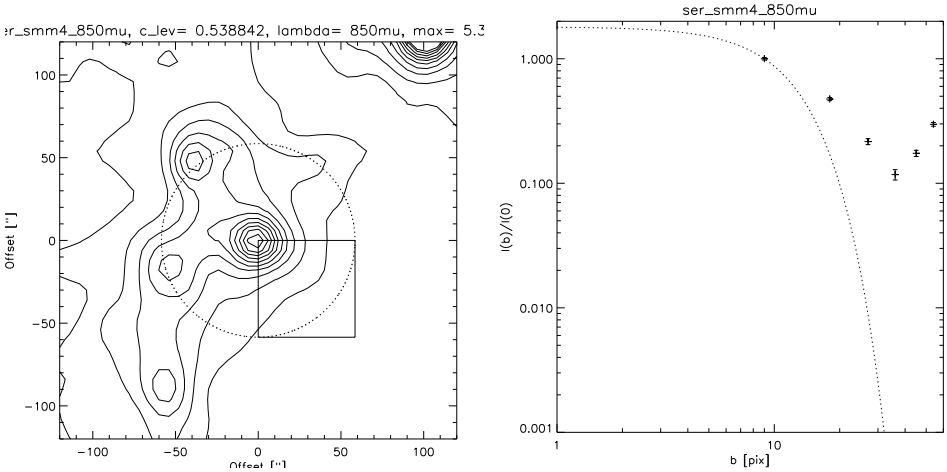

Figure 12.2: Map and radial emission profile of Ser-SMM4 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.61894600
       18.000000       0.40322000
       24.000000       0.26499400
       30.000000       0.17985200
       36.000000       0.12651100
       42.000000      0.095597200
       48.000000      0.072929300
       54.000000      0.064641100

850 mu:
       9.0000000        1.0000000
       18.000000       0.53698000
       27.000000       0.30948400
       36.000000       0.21540500
       45.000000       0.15324700
       54.000000       0.10764700

SED:
       54.250000   6.2267283e-18
       72.843000   7.9939050e-18
       108.07000   6.1929307e-17
       145.52500   9.1994506e-17
```

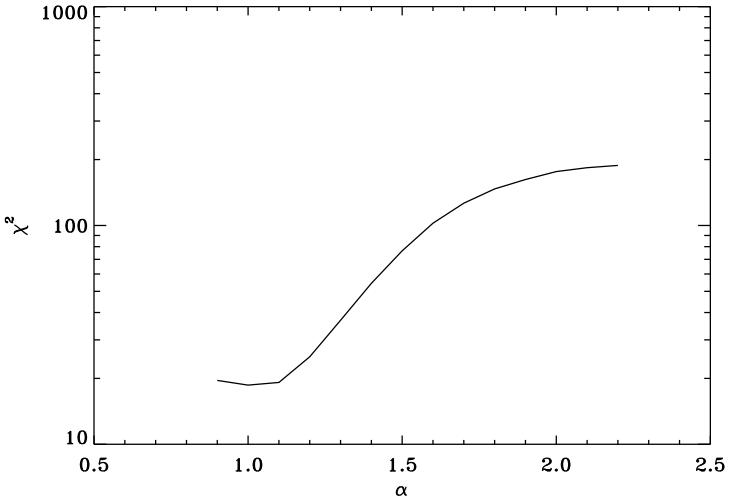

Figure 12.3: Reduced χ^2 as a function of the power-law density slope, α.

```
450.00000   2.0280001e-17
850.00000   1.9058824e-18
1100.0000   4.0090911e-19
```

All SED points are in units of W m^{-2}.

12.2 χ^2 results

12.2.1 DUSTY parameters

12.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
                r1 [AU] =      6.83
            r(10K) [AU] =  2.82e+03
              ni [cm-3] =  7.86e+08
      n(1000 AU) [cm-3] =  5.37e+06
         n(10 K) [cm-3] =  1.91e+06
     N(H2)(10 K) [cm-2] =  4.83e+23
Envelope mass(10K) [MS] =     2.109
```

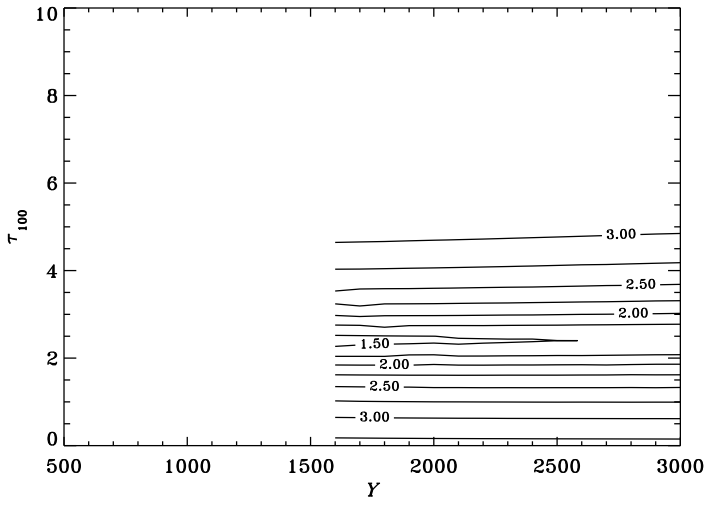

Figure 12.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

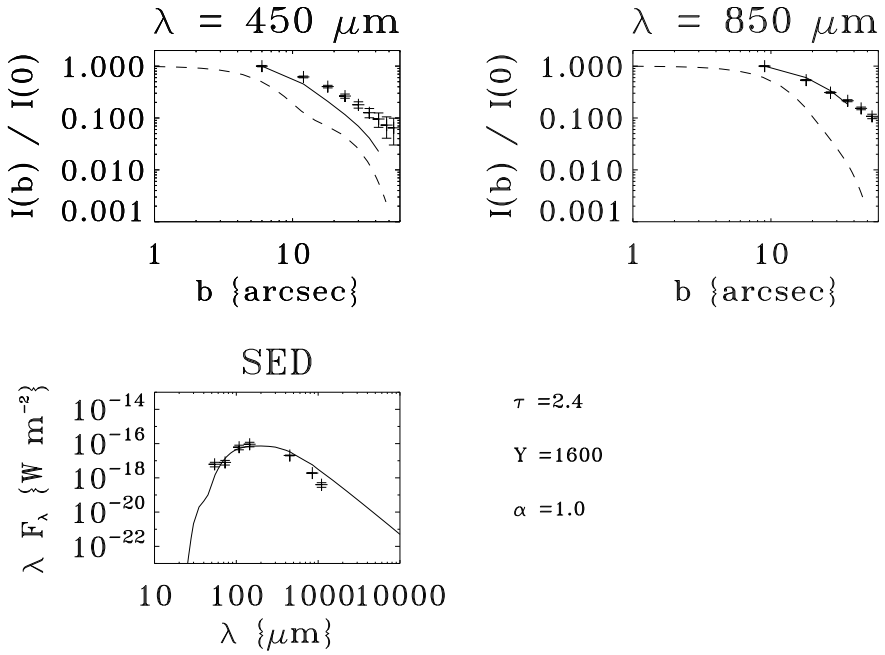

Figure 12.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

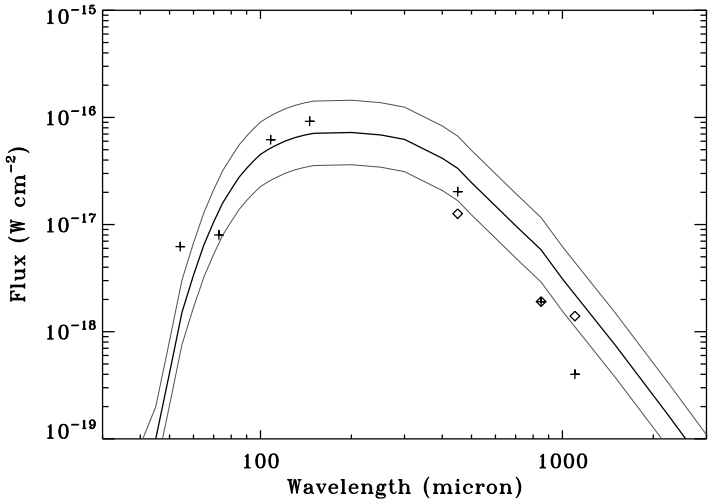

Figure 12.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 13

Ser-SMM3

13.1 Input data: radial profile, luminosity and SED

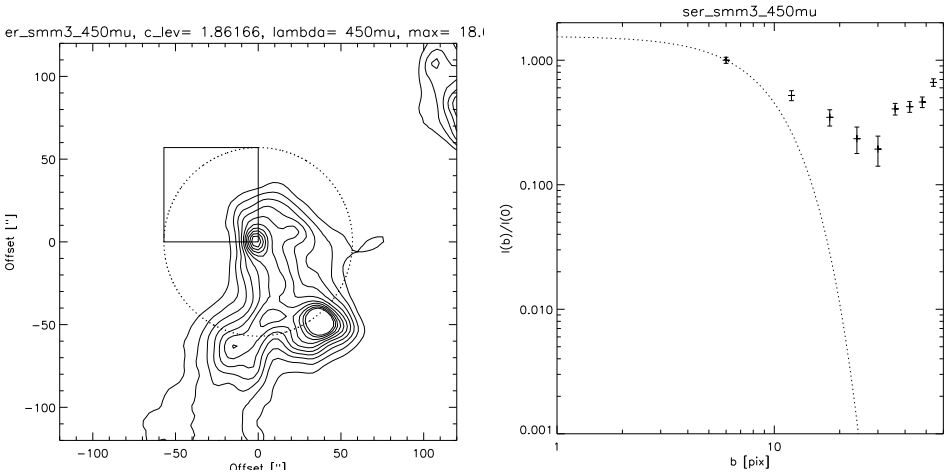

Figure 13.1: Map and radial emission profile of Ser-SMM3 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
ser_smm3
=========================
Luminosity =      5.10000
Distance =      230.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

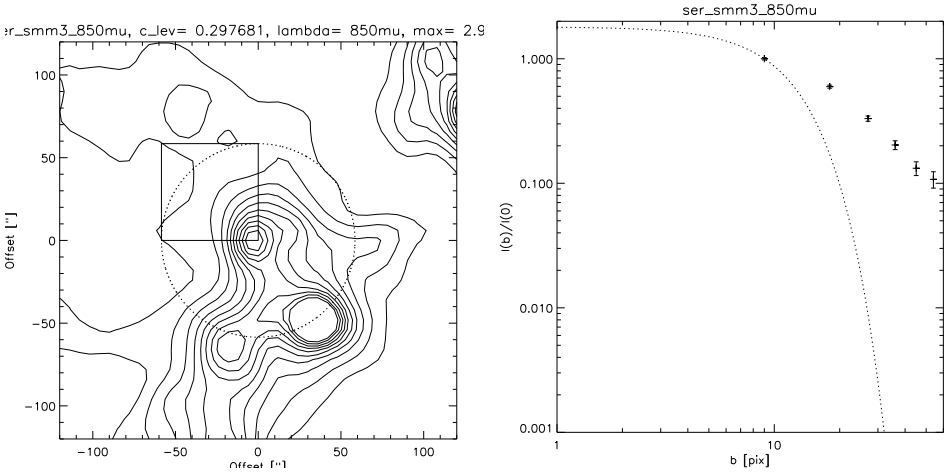

Figure 13.2: Map and radial emission profile of Ser-SMM3 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.66859900
       18.000000       0.48686600
       24.000000       0.37927700
       30.000000       0.29339300
       36.000000       0.23614600
       42.000000       0.20632300
       48.000000       0.17605600
       54.000000       0.14409100

850 mu:
       9.0000000        1.0000000
       18.000000       0.66833600
       27.000000       0.44897900
       36.000000       0.34368000
       45.000000       0.28465100
       54.000000       0.24159900

SED:
       69.300000   9.2415588e-17
       89.990000   1.3286477e-16
       108.07000   2.4417786e-16
       118.58100   2.4767122e-16
```

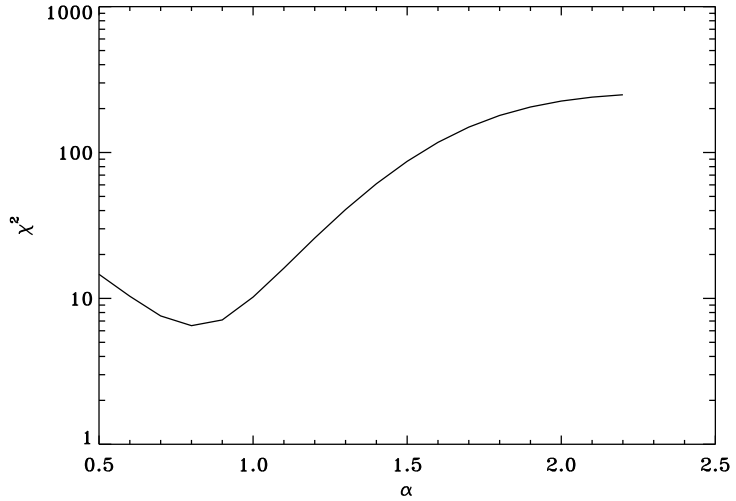

Figure 13.3: Reduced χ^2 as a function of the power-law density slope, α.

```
138.52800   2.5376820e-16
157.70000   2.4437921e-16
179.52700   1.9212153e-16
450.00000   1.2413334e-17
850.00000   1.0517647e-18
1100.0000   3.0272728e-19
```

All SED points are in units of W m^{-2}.

13.2 χ^2 results

13.2.1 DUSTY parameters

13.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
                r1 [AU] =      8.94
           r(10K) [AU] =  6.70e+03
             ni [cm-3] =  4.72e+07
      n(1000 AU) [cm-3] =  1.08e+06
         n(10 K) [cm-3] =  2.36e+05
     N(H2)(10 K) [cm-2] =  8.70e+22
Envelope mass(10K) [MS] =     3.208
```

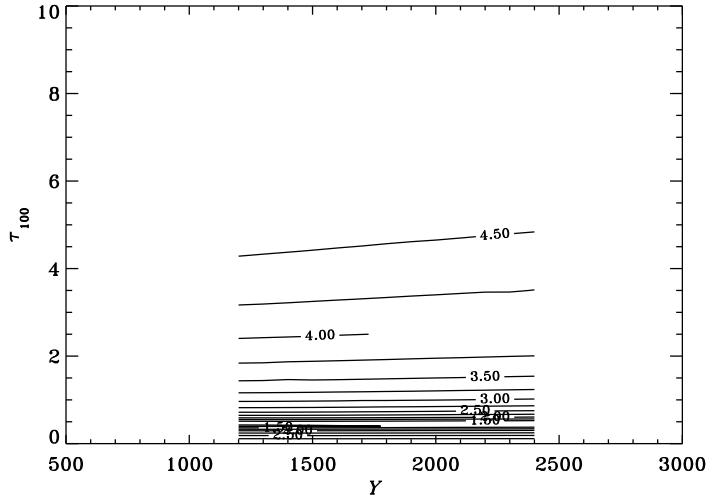

Figure 13.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

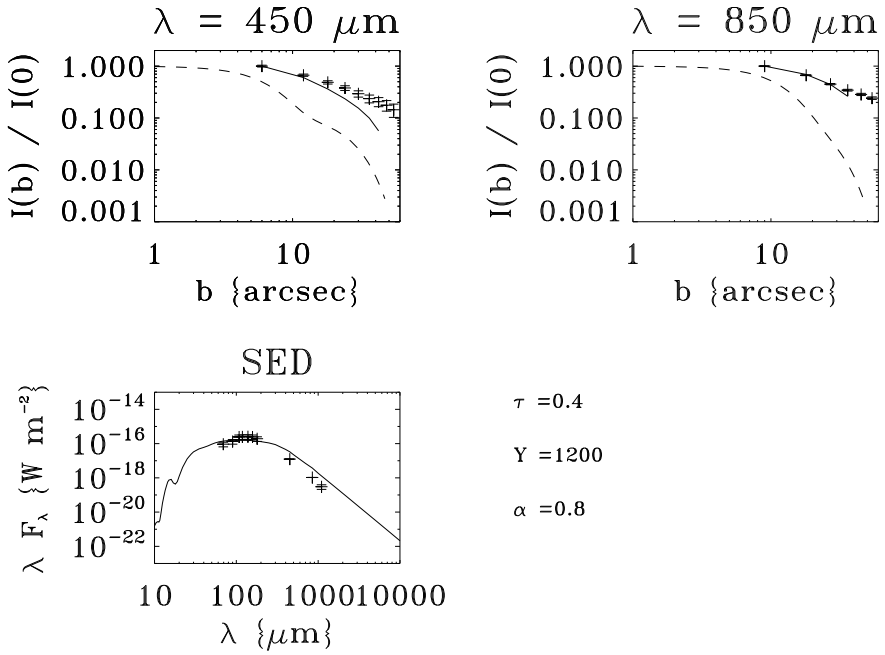

Figure 13.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

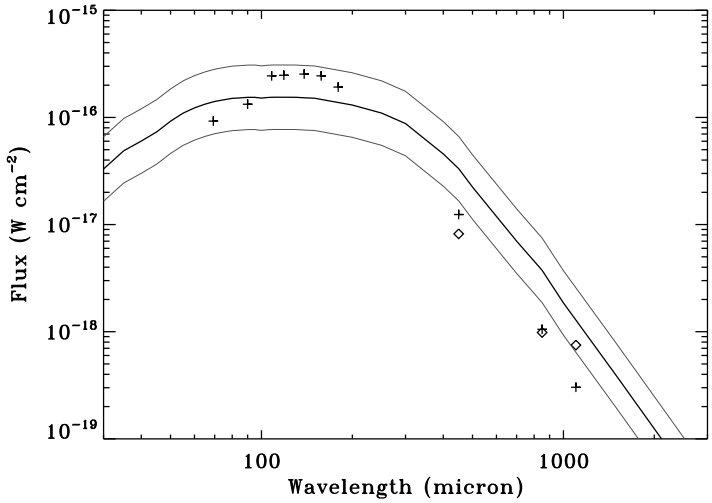

Figure 13.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 14

L723

14.1 Input data: radial profile, luminosity and SED

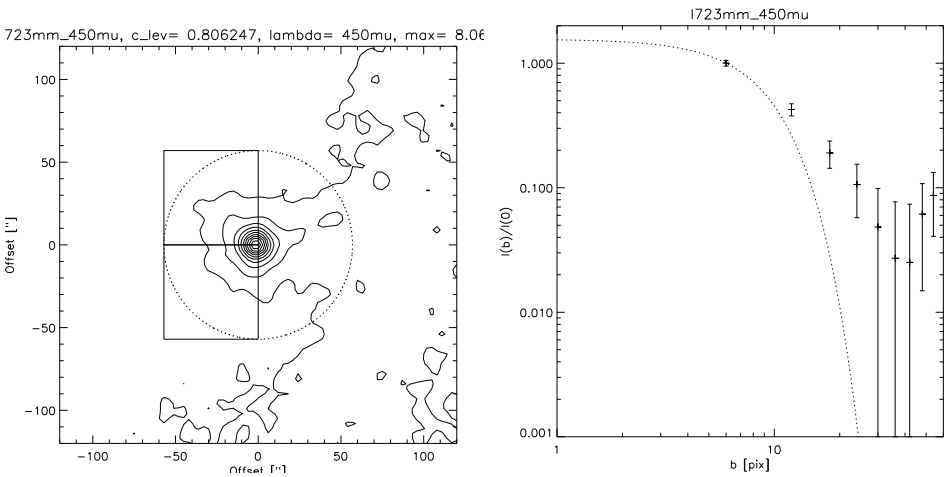

Figure 14.1: Map and radial emission profile of L723 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
l723mm
========================
Luminosity =      3.60000
Distance =      300.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

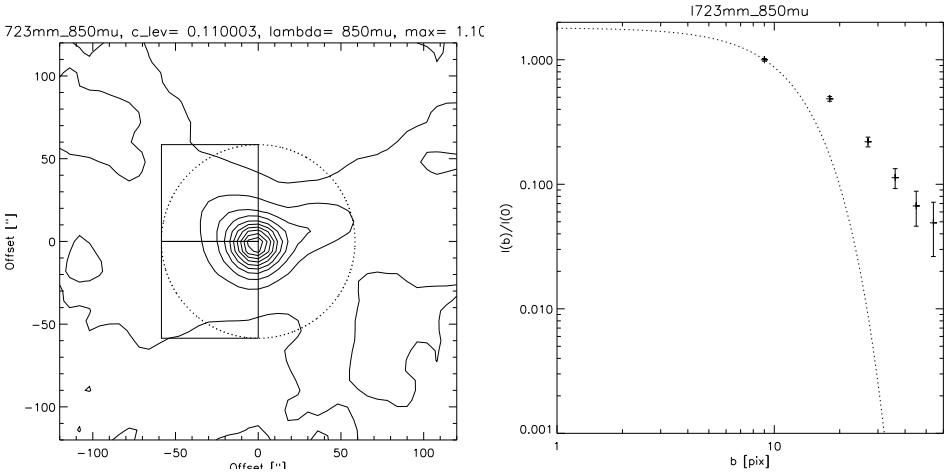

Figure 14.2: Map and radial emission profile of L723 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.45684500
       18.000000       0.27346100
       24.000000       0.19037200
       30.000000       0.11527600
       36.000000      0.078095100
       42.000000      0.065103300
       48.000000      0.051137300
       54.000000      0.036267300

850 mu:
       9.0000000        1.0000000
       18.000000       0.54605200
       27.000000       0.31126800
       36.000000       0.21653000
       45.000000       0.16915100
       54.000000       0.14374200

SED:
       69.300000   6.3281388e-17
       89.990000   6.9074344e-17
       108.07000   9.5557513e-17
       118.58100   9.0740510e-17
```

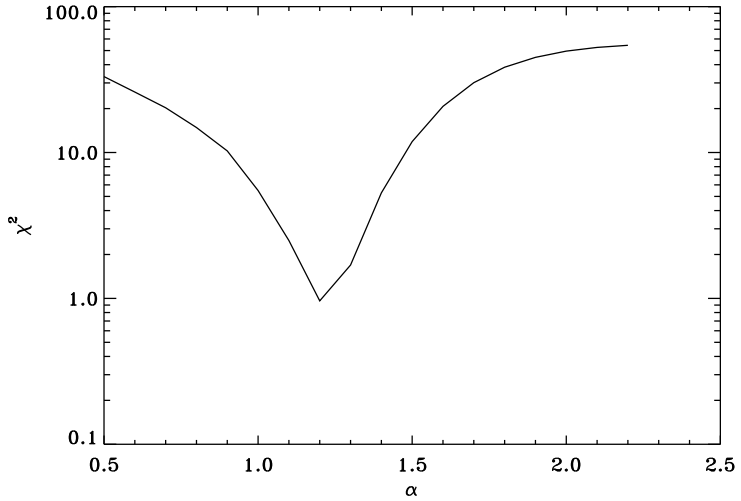

Figure 14.3: Reduced χ^2 as a function of the power-law density slope, α.

```
138.52800   8.2950020e-17
157.70000   7.5270136e-17
179.52700   6.0654389e-17
450.00000   5.3733335e-18
850.00000   3.8470590e-19
1300.0000   8.5384619e-20
```

All SED points are in units of W m^{-2}.

14.2 χ^2 results

14.2.1 DUSTY parameters

14.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
                r1 [AU] =      8.35
            r(10K) [AU] =  6.63e+03
              ni [cm-3] =  2.48e+08
      n(1000 AU) [cm-3] =  7.96e+05
         n(10 K) [cm-3] =  8.22e+04
     N(H2)(10 K) [cm-2] =  1.14e+23
Envelope mass(10K) [MS] =     1.320
```

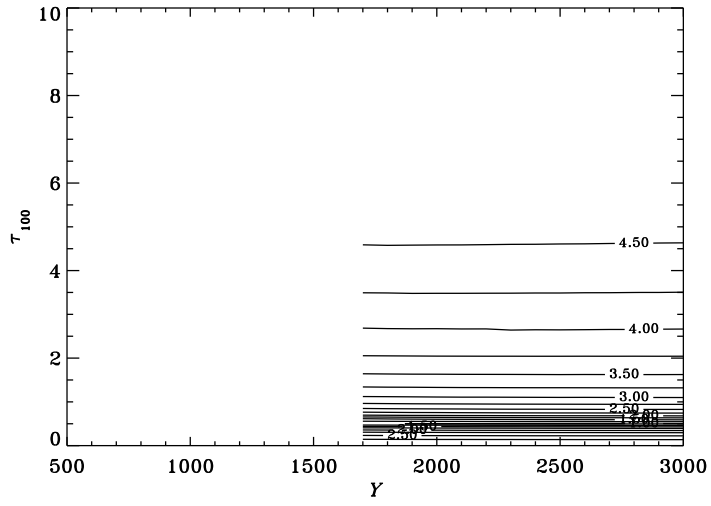

Figure 14.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

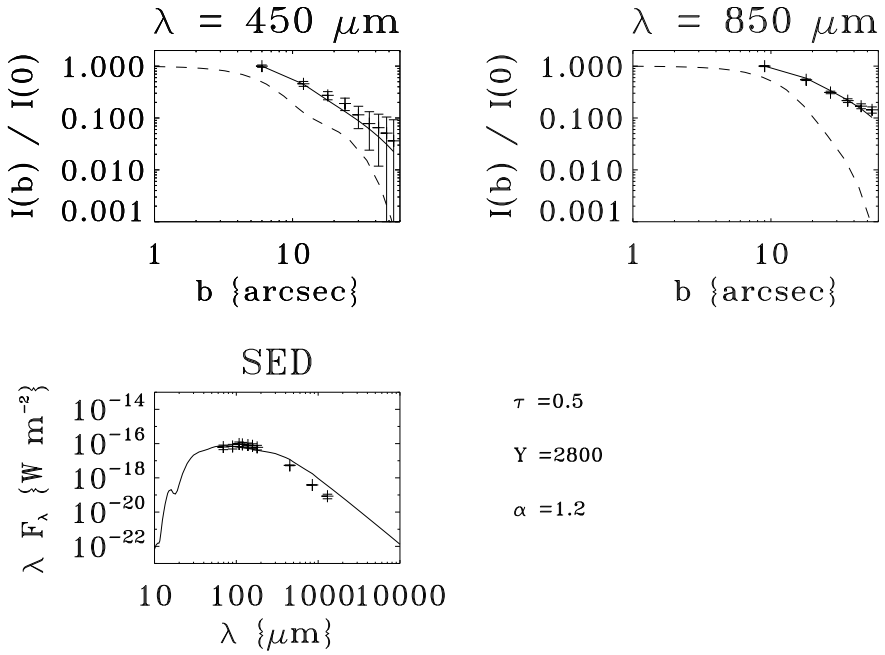

Figure 14.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

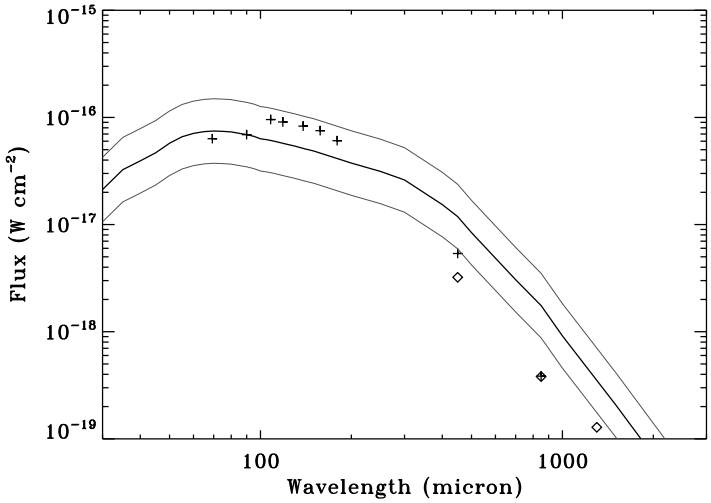

Figure 14.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 15

B335

15.1 Input data: radial profile, luminosity and SED

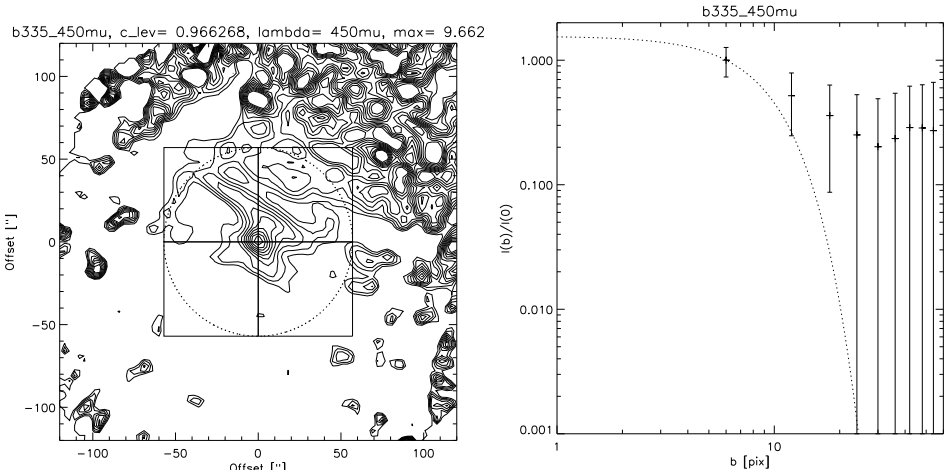

Figure 15.1: Map and radial emission profile of B335 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
b335
========================
Luminosity =      3.30000
Distance =      250.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

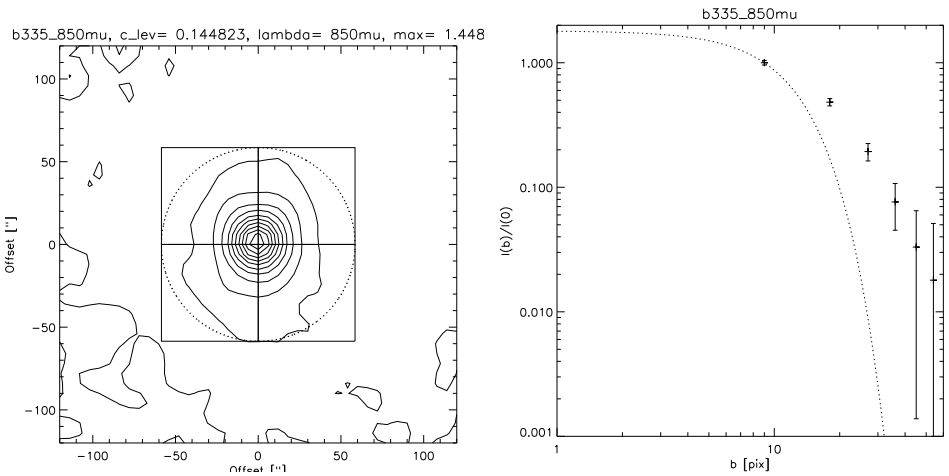

Figure 15.2: Map and radial emission profile of B335 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.54161500
       18.000000       0.39545200
       24.000000       0.29974400
       30.000000       0.24597900
       36.000000       0.22666800
       42.000000       0.27226300
       48.000000       0.31983100
       54.000000       0.29378200

850 mu:
       9.0000000        1.0000000
       18.000000       0.53166300
       27.000000       0.26935900
       36.000000       0.15884300
       45.000000      0.099085600
       54.000000      0.067780200

SED:
       60.000000   4.7296122e-17
       70.000000   6.4449975e-17
       80.000000   1.1475702e-16
       90.000000   1.1151999e-16
```

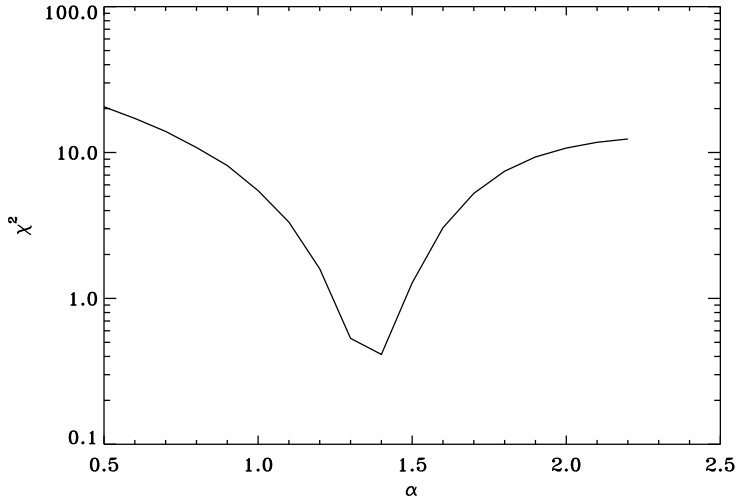

Figure 15.3: Reduced χ^2 as a function of the power-law density slope, α.

```
110.00000   1.3979129e-16
120.00000   1.3621001e-16
130.00000   1.3852984e-16
140.00000   1.3654236e-16
150.00000   1.2591081e-16
160.00000   1.2196769e-16
170.00000   1.1144052e-16
180.00000   1.0812174e-16
450.00000   6.4400002e-18
850.00000   5.1176472e-19
1100.0000   1.8545455e-19
```

All SED points are in units of W m^{-2}.

15.2 χ^2 results

15.2.1 DUSTY parameters

15.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
               r1 [AU] =      9.78
           r(10K) [AU] =  4.87e+03
             ni [cm-3] =  1.00e+09
      n(1000 AU) [cm-3] =  1.54e+06
         n(10 K) [cm-3] =  1.68e+05
     N(H2)(10 K) [cm-2] =  3.36e+23
```

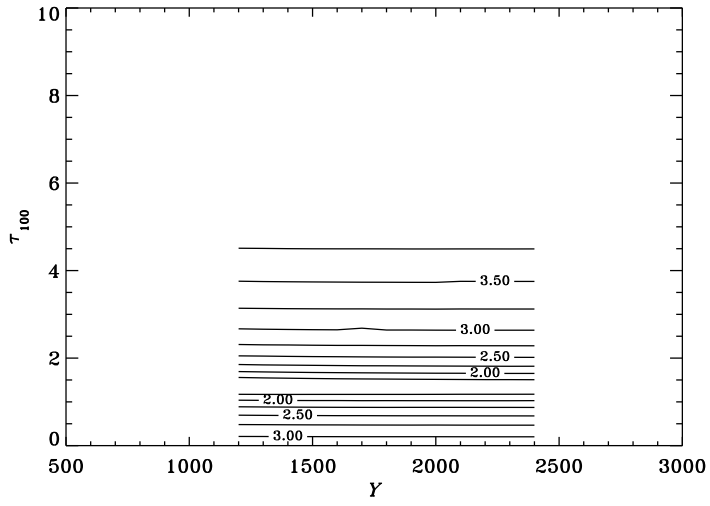

Figure 15.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

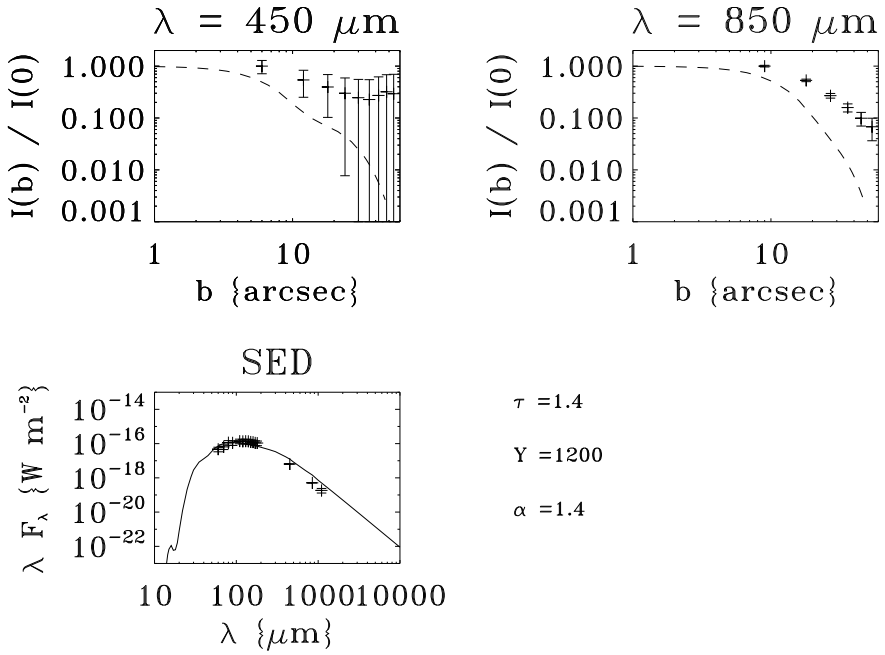

Figure 15.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

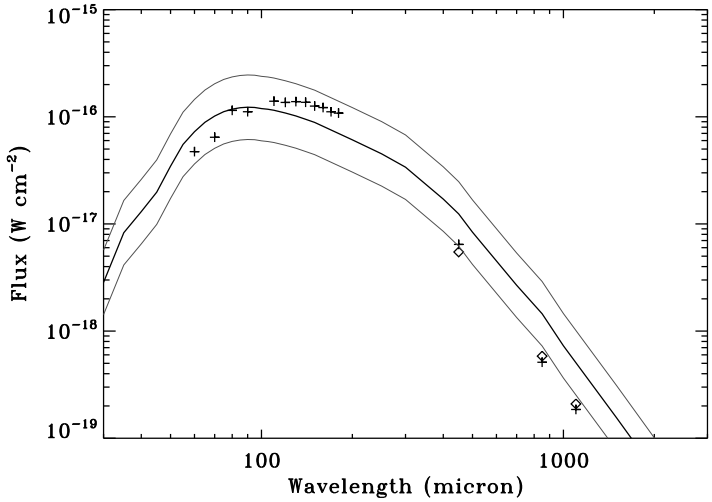

Figure 15.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

```
Envelope mass(10K) [MS] =     1.200
```

Chapter 16

L1157

16.1 Input data: radial profile, luminosity and SED

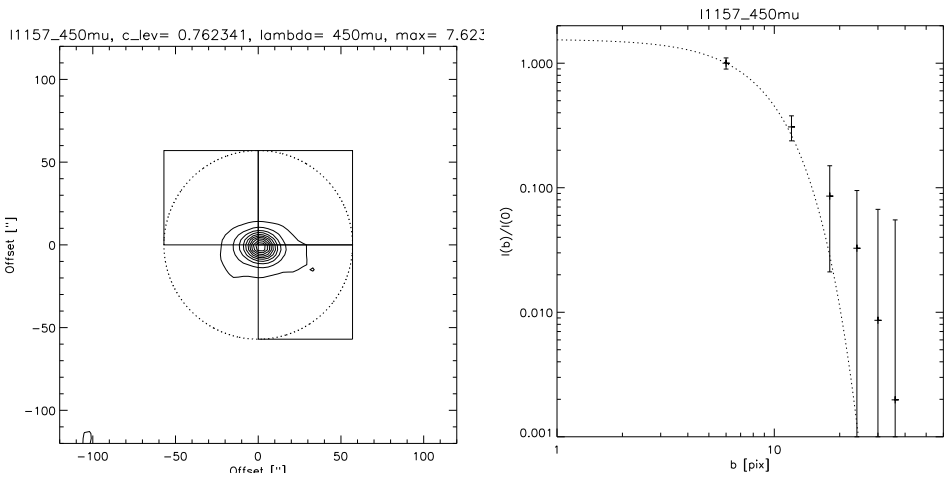

Figure 16.1: Map and radial emission profile of L1157 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
l1157
=========================
Luminosity =      4.70000
Distance =      325.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

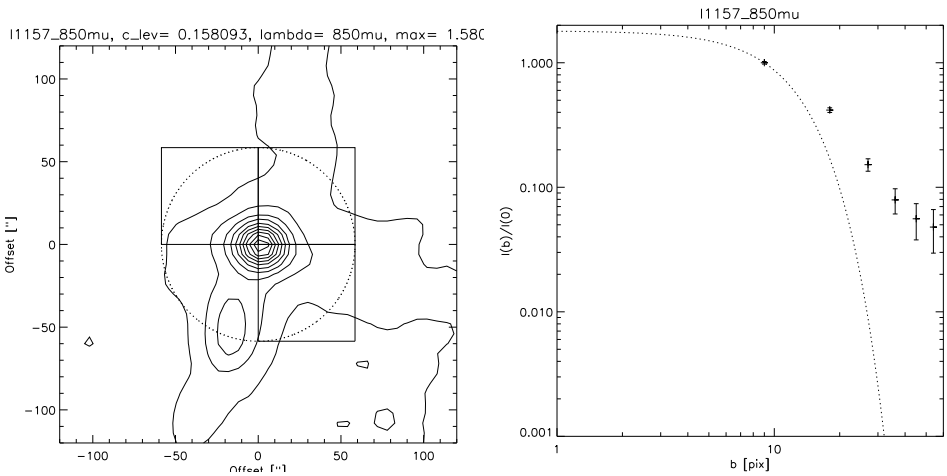

Figure 16.2: Map and radial emission profile of L1157 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.42107600
       18.000000       0.18089400
       24.000000       0.10774500
       30.000000      0.081809000
       36.000000      0.068907600
       42.000000      0.057829900
       48.000000      0.050422300
       54.000000      0.043900300

850 mu:
       9.0000000        1.0000000
       18.000000       0.41683900
       27.000000       0.15195200
       36.000000      0.079176200
       45.000000      0.055843900
       54.000000      0.047914800

SED:
       60.000000   7.3242713e-17
       70.000000   6.8682058e-17
       80.000000   5.6733242e-17
       90.000000   6.3656929e-17
```

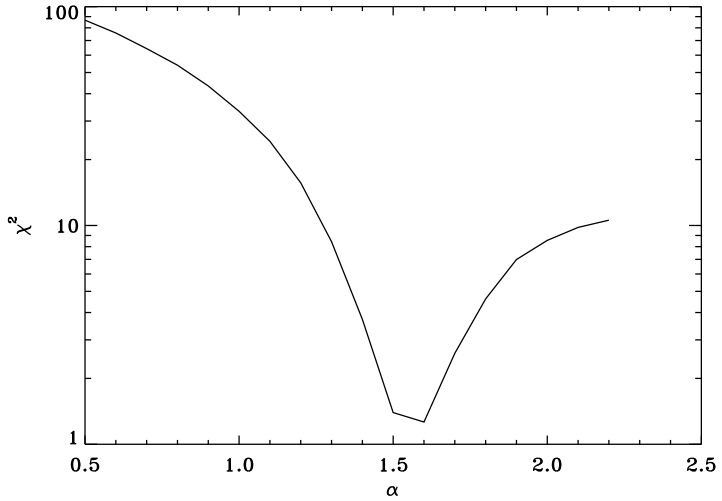

Figure 16.3: Reduced χ^2 as a function of the power-law density slope, α.

```
110.00000   6.5461072e-17
120.00000   6.0662200e-17
130.00000   6.2831132e-17
140.00000   6.2835499e-17
150.00000   5.6251750e-17
160.00000   5.7072394e-17
170.00000   5.2062898e-17
180.00000   5.1031397e-17
450.00000   5.0866669e-18
850.00000   5.5764708e-19
1300.0000   1.3384616e-19
```

All SED points are in units of W m^{-2}.

16.2 χ^2 results

16.2.1 DUSTY parameters

16.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
               r1 [AU] =     14.38
           r(10K) [AU] =  5.43e+03
             ni [cm-3] =  1.74e+09
      n(1000 AU) [cm-3] =  1.96e+06
         n(10 K) [cm-3] =  1.31e+05
     N(H2)(10 K) [cm-2] =  6.05e+23
```

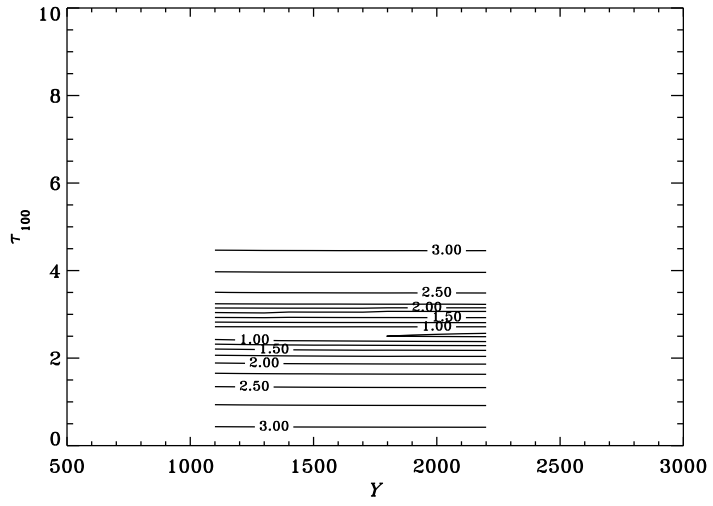

Figure 16.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

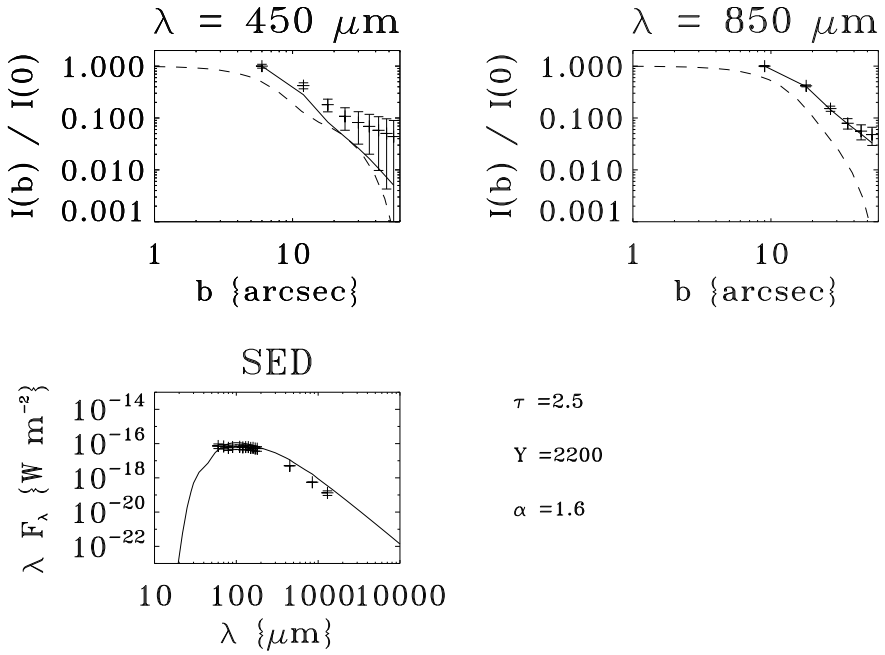

Figure 16.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

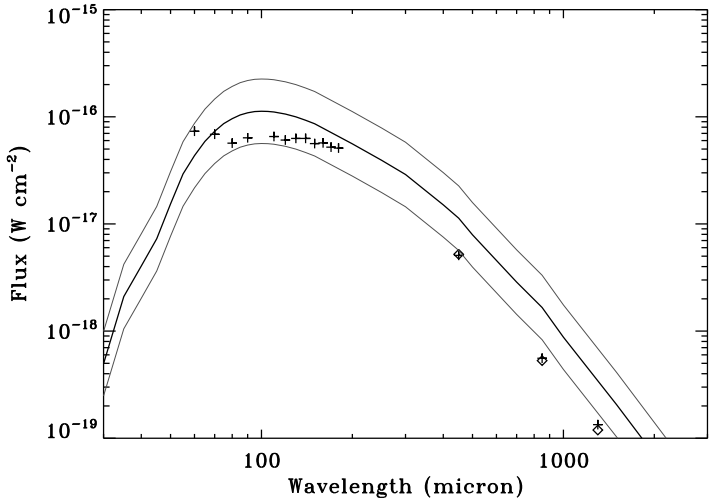

Figure 16.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

```
Envelope mass(10K) [MS] =     1.483
```

Chapter 17

NGC1333 IRAS3

17.1 Input data: radial profile, luminosity and SED

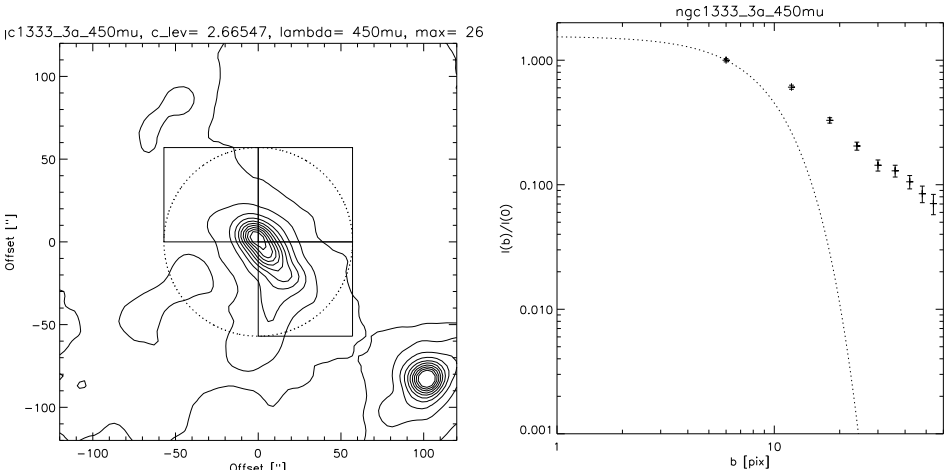

Figure 17.1: Map and radial emission profile of NGC1333 IRAS3 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
ngc1333_3a
==========================
Luminosity =      41.8000
Distance =      235.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

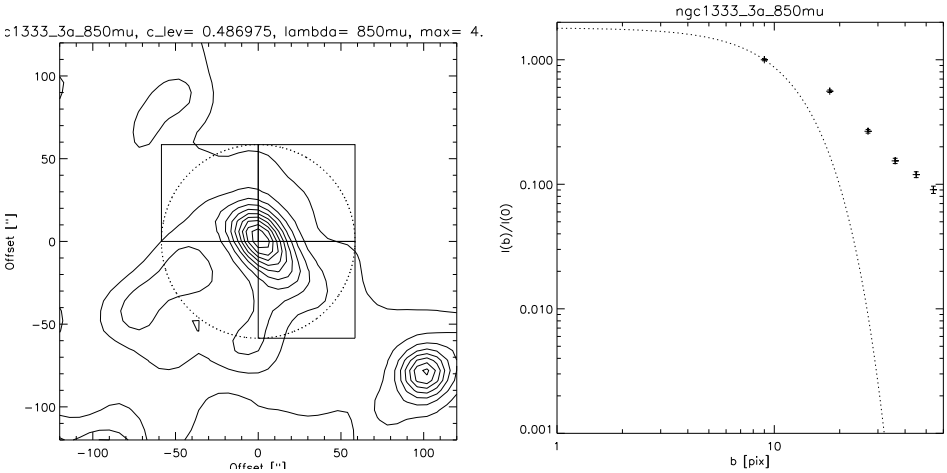

Figure 17.2: Map and radial emission profile of NGC1333 IRAS3 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.75191800
       18.000000       0.43440400
       24.000000       0.25873100
       30.000000       0.16738500
       36.000000       0.11601700
       42.000000       0.10300700
       48.000000      0.083366900
       54.000000      0.070840000

850 mu:
       9.0000000        1.0000000
       18.000000       0.55926900
       27.000000       0.26659300
       36.000000       0.15425500
       45.000000       0.11958600
       54.000000      0.090473400

SED:
       60.000000   9.8500004e-16
       100.00000   1.0470000e-15
       450.00000   1.8253334e-17
       850.00000   1.7188236e-18
```

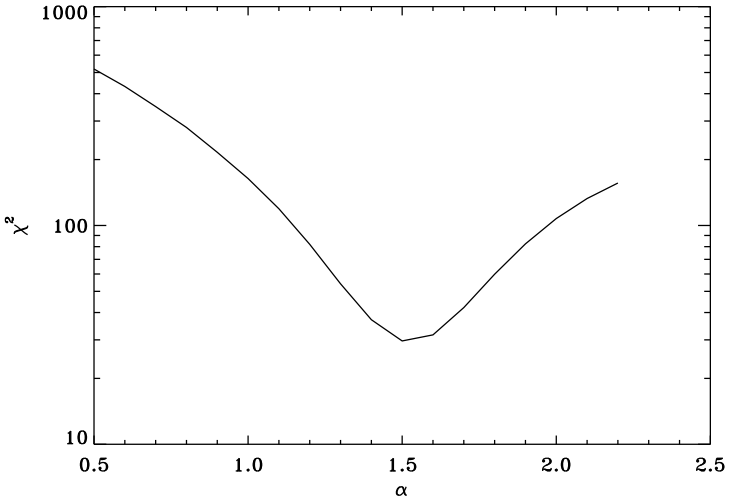

Figure 17.3: Reduced χ^2 as a function of the power-law density slope, α.

```
   1100.0000   7.3636366e-19
```

All SED points are in units of W m^{-2}.

17.2 χ^2 results

17.2.1 DUSTY parameters

17.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
               r1 [AU] =     35.18
           r(10K) [AU] =  1.76e+04
             ni [cm-3] =  2.94e+08
      n(1000 AU) [cm-3] =  1.94e+06
         n(10 K) [cm-3] =  2.63e+04
     N(H2)(10 K) [cm-2] =  2.96e+23
Envelope mass(10K) [MS] =     9.470
```

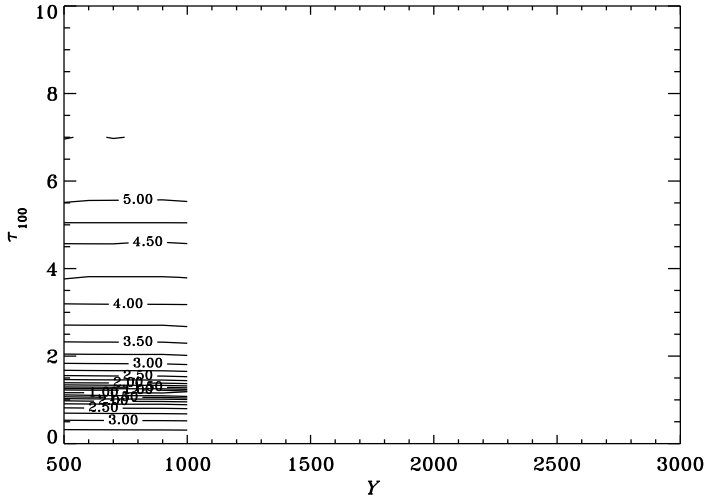

Figure 17.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

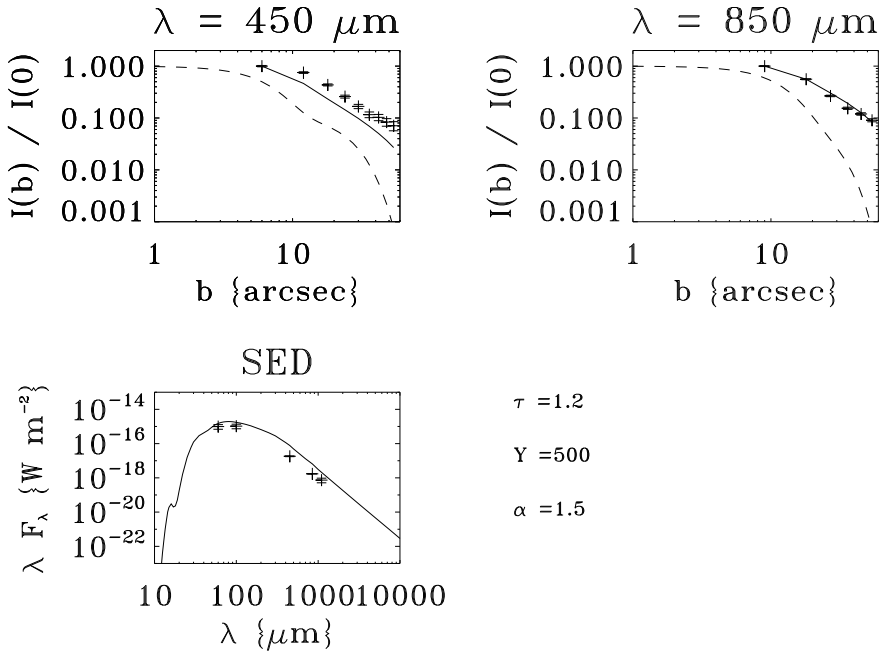

Figure 17.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

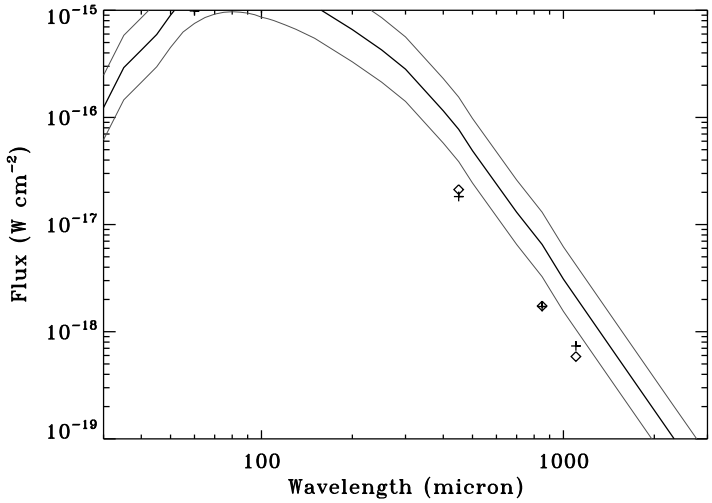

Figure 17.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 18

L1489

18.1 Input data: radial profile, luminosity and SED

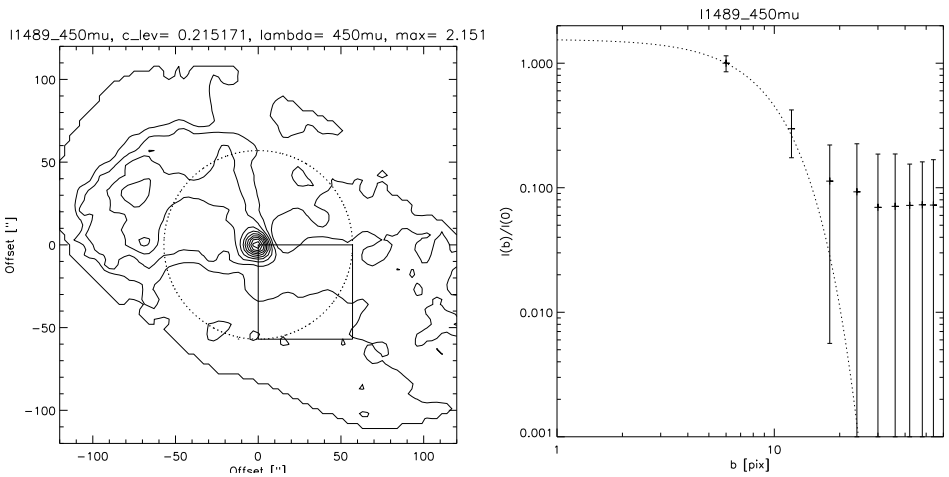

Figure 18.1: Map and radial emission profile of L1489 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
l1489
=========================
Luminosity =      3.80000
Distance =      140.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

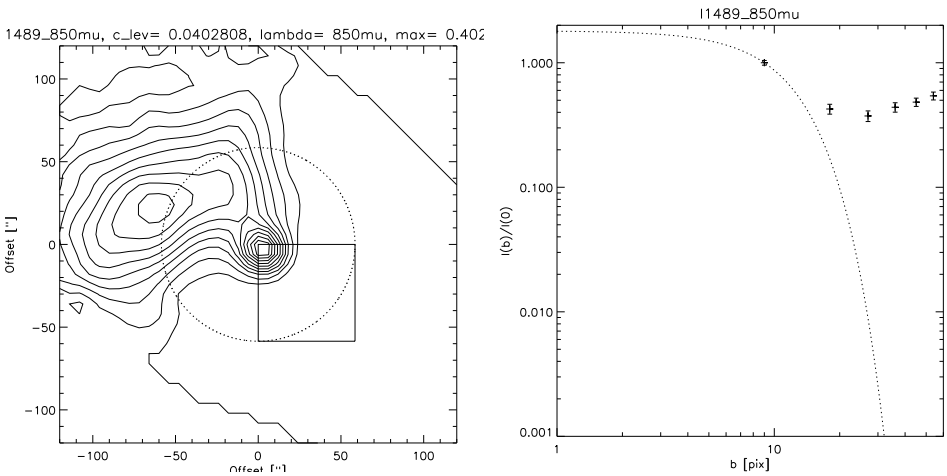

Figure 18.2: Map and radial emission profile of L1489 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.46460900
       18.000000       0.15455800
       24.000000      0.093981900
       30.000000      0.078187000
       36.000000      0.067810900
       42.000000      0.075782900
       48.000000      0.079496000
       54.000000      0.080404900

850 mu:
       9.0000000        1.0000000
       18.000000       0.55423100
       27.000000       0.27671000
       36.000000       0.19302800
       45.000000       0.17819800
       54.000000       0.17285300

SED:
       69.300000   2.1131170e-16
       89.990000   1.6908213e-16
       108.07000   1.7421764e-16
       118.58100   1.5331546e-16
```

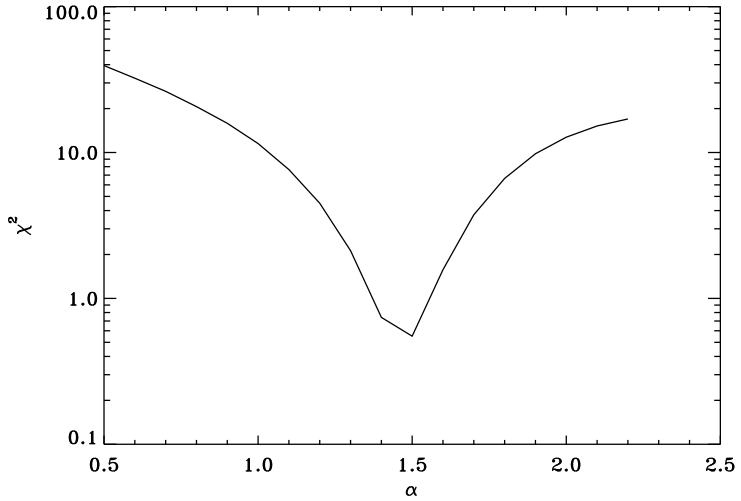

Figure 18.3: Reduced χ^2 as a function of the power-law density slope, α.

```
138.52800   1.2017066e-16
157.70000   9.9091316e-17
179.52700   7.0399998e-17
450.00000   1.4333334e-18
850.00000   1.4117648e-19
1100.0000   4.9090911e-20
```

All SED points are in units of W m^{-2}.

18.2 χ^2 results

18.2.1 DUSTY parameters

18.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
                r1 [AU] =      8.37
            r(10K) [AU] =  6.69e+03
              ni [cm-3] =  2.04e+08
      n(1000 AU) [cm-3] =  1.56e+05
         n(10 K) [cm-3] =  9.03e+03
     N(H2)(10 K) [cm-2] =  4.93e+22
Envelope mass(10K) [MS] =     0.179
```

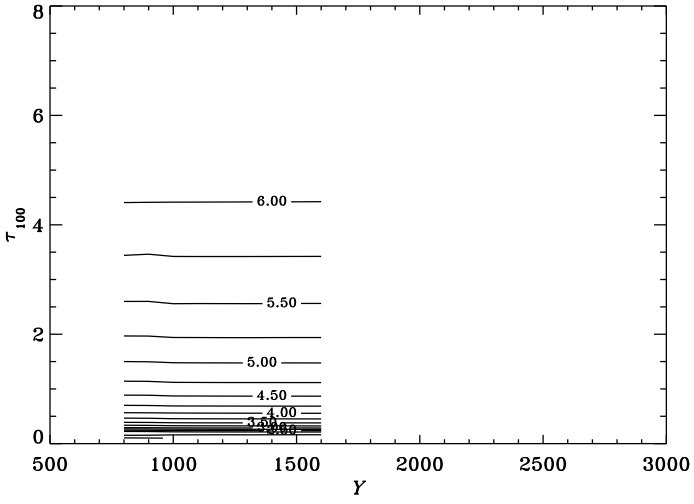

Figure 18.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

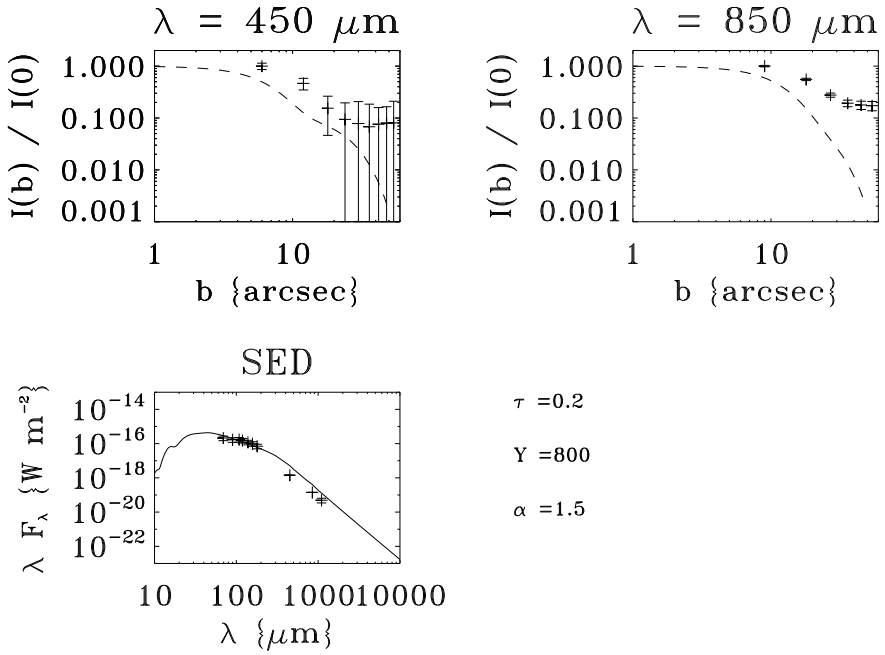

Figure 18.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

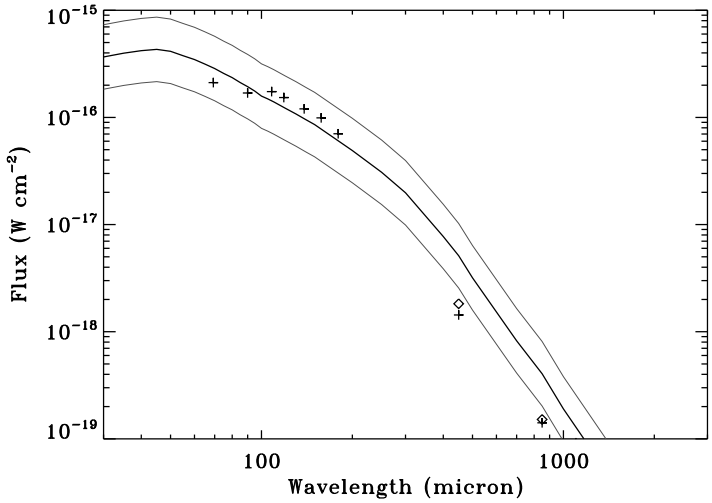

Figure 18.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 19

L1551-IRS5

19.1 Input data: radial profile, luminosity and SED

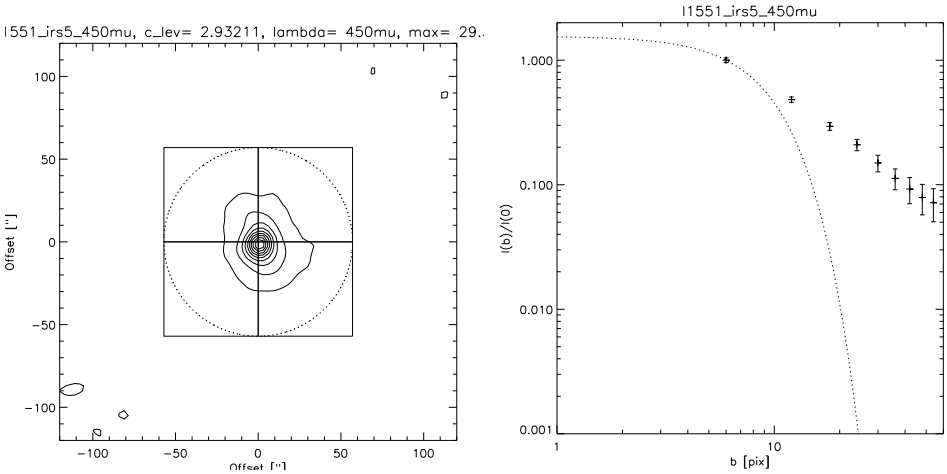

Figure 19.1: Map and radial emission profile of L1551-IRS5 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
l1551_irs5
==========================
Luminosity =      22.2000
Distance =      140.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

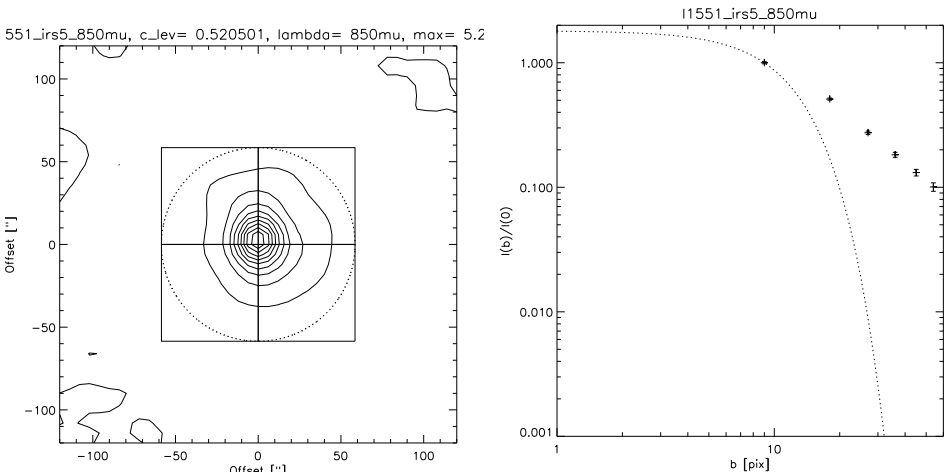

Figure 19.2: Map and radial emission profile of L1551-IRS5 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.50463600
       18.000000       0.26757500
       24.000000       0.16654800
       30.000000       0.10377600
       36.000000      0.064984000
       42.000000      0.040811500
       48.000000      0.028107700
       54.000000      0.020380800

850 mu:
       9.0000000        1.0000000
       18.000000       0.48060700
       27.000000       0.22931800
       36.000000       0.13186200
       45.000000      0.077370900
       54.000000      0.044916000

SED:
       60.000000   2.0461912e-15
       70.000000   1.9943435e-15
       80.000000   1.7052956e-15
       90.000000   1.6466892e-15
```

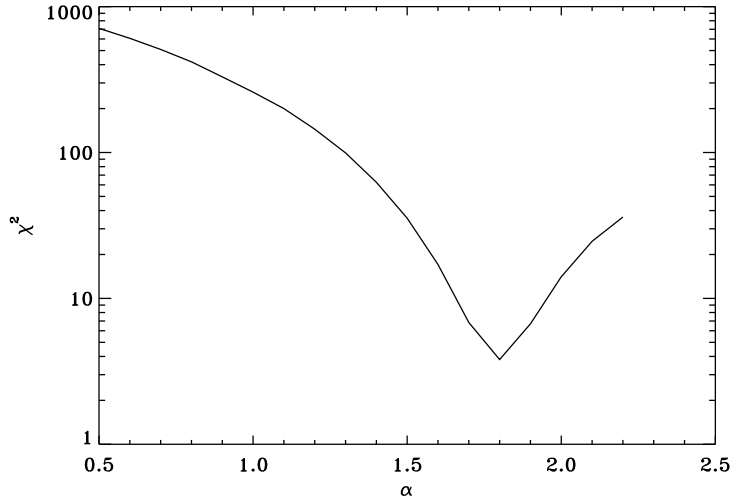

Figure 19.3: Reduced χ^2 as a function of the power-law density slope, α.

```
110.00000   1.5875032e-15
120.00000   1.4154570e-15
130.00000   1.2984660e-15
140.00000   1.1611615e-15
150.00000   9.3744155e-16
160.00000   8.5256156e-16
170.00000   7.1180687e-16
180.00000   6.5338507e-16
450.00000   1.9546667e-17
850.00000   1.8388236e-18
1100.0000   7.5545457e-19
```

All SED points are in units of W m^{-2}.

19.2 χ^2 results

19.2.1 DUSTY parameters

19.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
               r1 [AU] =     28.94
           r(10K) [AU] =  1.42e+04
             ni [cm-3] =  6.87e+08
      n(1000 AU) [cm-3] =  1.17e+06
         n(10 K) [cm-3] =  9.88e+03
     N(H2)(10 K) [cm-2] =  3.69e+23
```

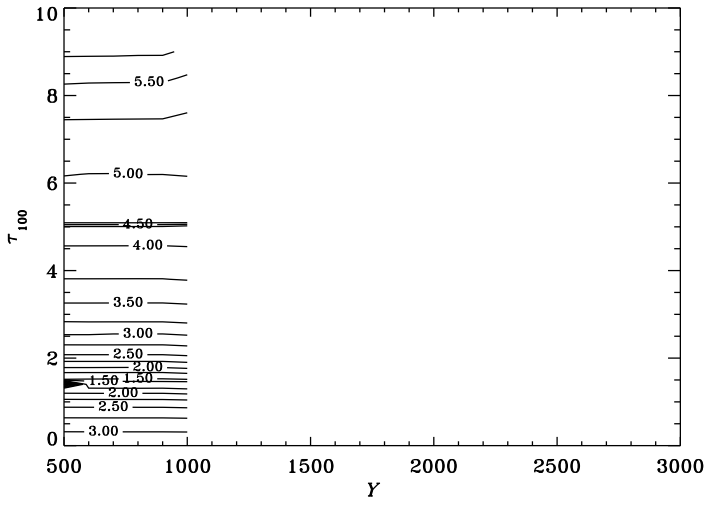

Figure 19.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

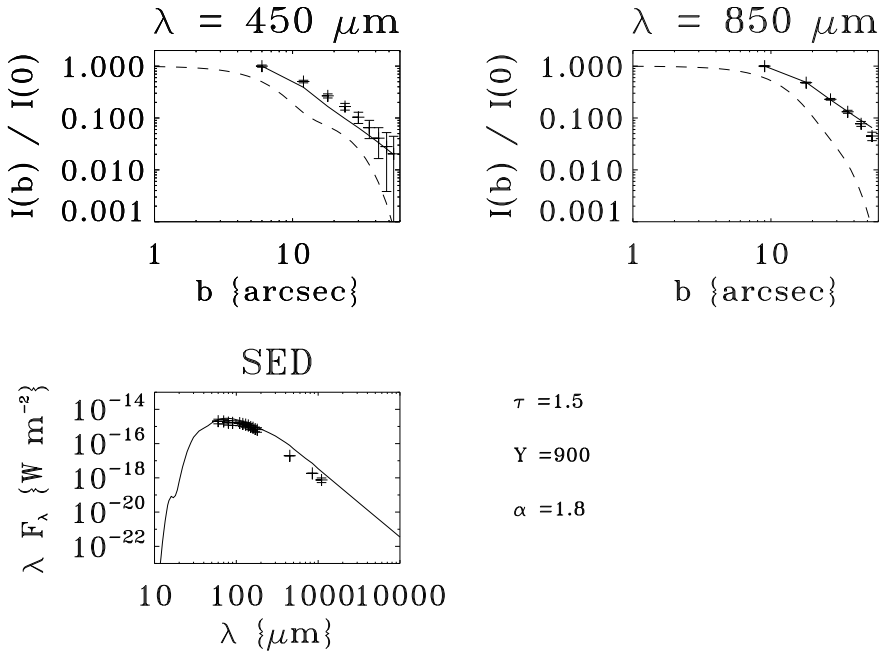

Figure 19.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

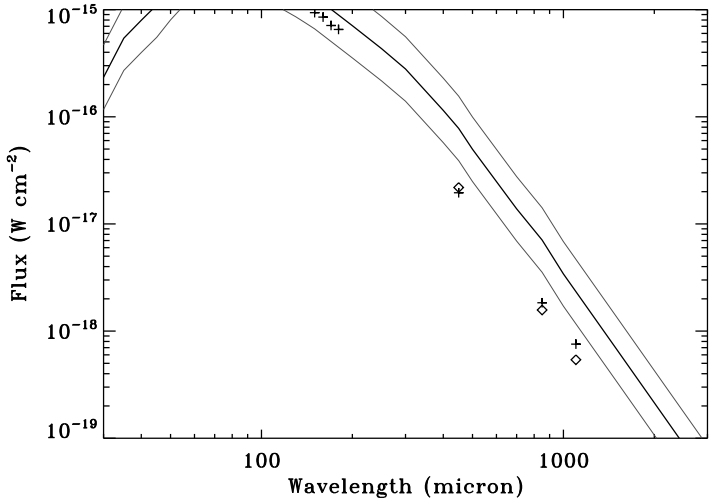

Figure 19.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

```
Envelope mass(10K) [MS] =     2.324
```

Chapter 20

TMR1

20.1 Input data: radial profile, luminosity and SED

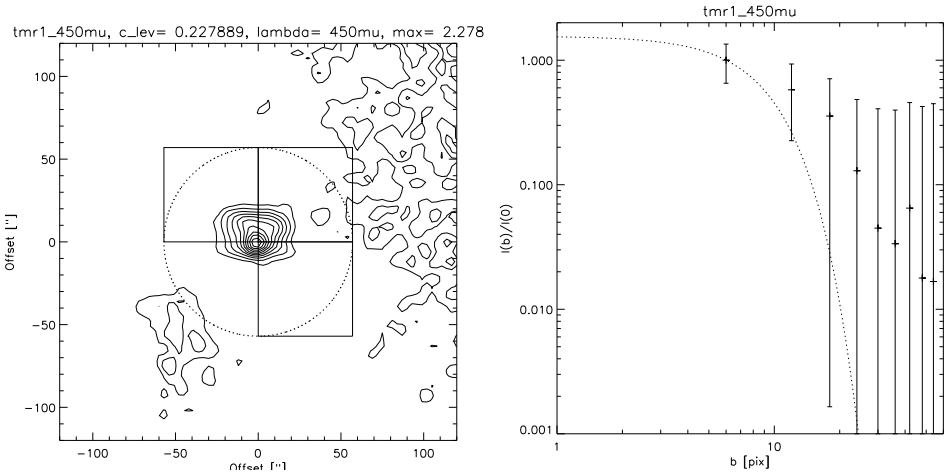

Figure 20.1: Map and radial emission profile of TMR1 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
tmr1
=========================
Luminosity =      3.80000
Distance =      140.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

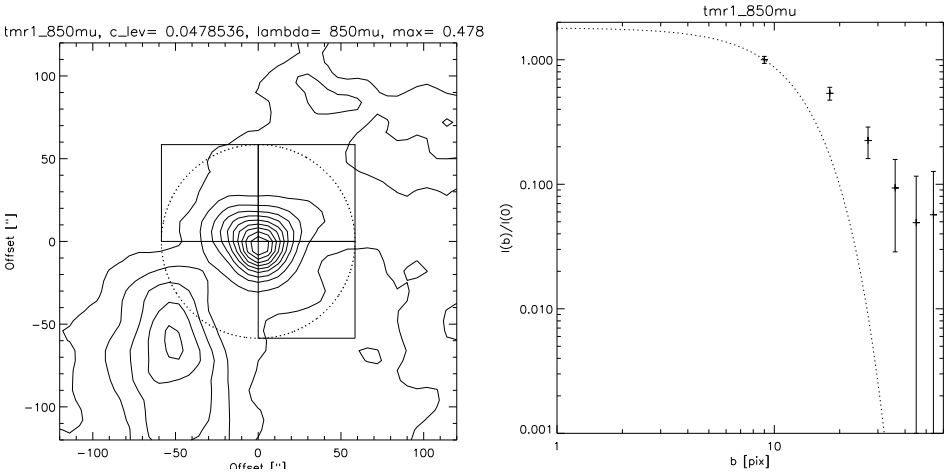

Figure 20.2: Map and radial emission profile of TMR1 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.66522400
       18.000000       0.34519700
       24.000000       0.14776300
       30.000000      0.063989200
       36.000000      0.071943200
       42.000000      0.076767600
       48.000000      0.082734600
       54.000000      0.072700700

850 mu:
       9.0000000        1.0000000
       18.000000       0.53740700
       27.000000       0.22451500
       36.000000      0.093448300
       45.000000      0.049213800
       54.000000      0.056921800

SED:
       69.300000   1.6615152e-16
       89.990000   1.1614291e-16
       108.07000   1.3550940e-16
       118.58100   1.2358388e-16
```

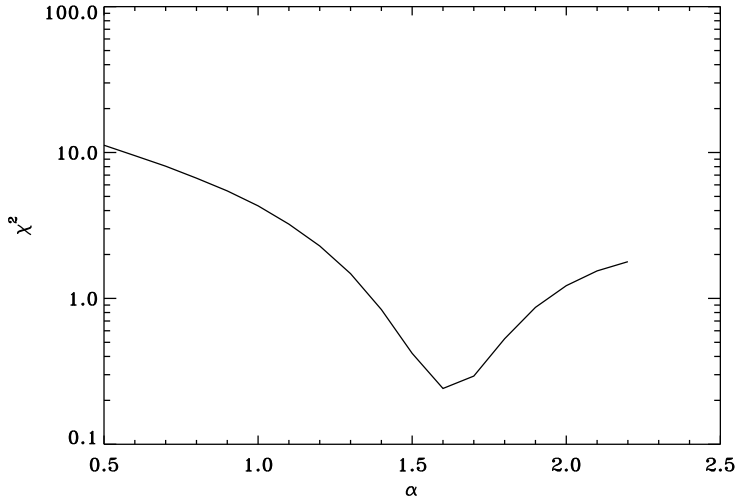

Figure 20.3: Reduced χ^2 as a function of the power-law density slope, α.

```
138.52800   1.0455865e-16
157.70000   8.7437543e-17
179.52700   5.8672514e-17
450.00000   1.5266667e-18
850.00000   1.6941177e-19
1100.0000   5.1272729e-20
```

All SED points are in units of W m^{-2}.

20.2 χ^2 results

20.2.1 DUSTY parameters

20.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
                r1 [AU] =      8.81
            r(10K) [AU] =  7.93e+03
              ni [cm-3] =  4.12e+08
      n(1000 AU) [cm-3] =  2.12e+05
           N(H2) [cm-2] =  8.90e+22
Envelope mass(10K) [MS] =     0.227
```

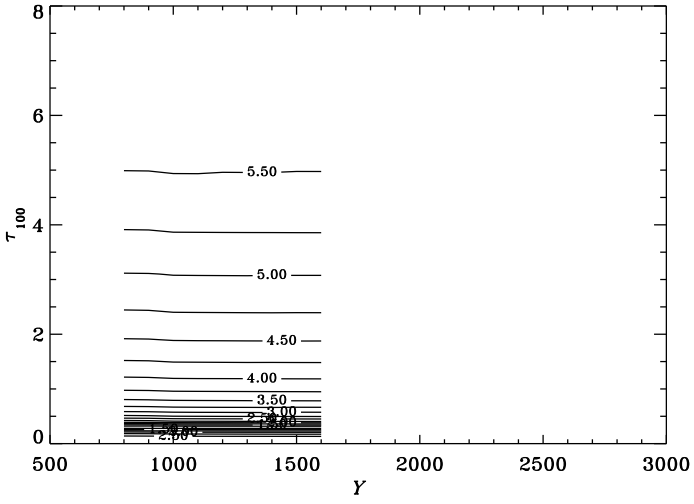

Figure 20.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

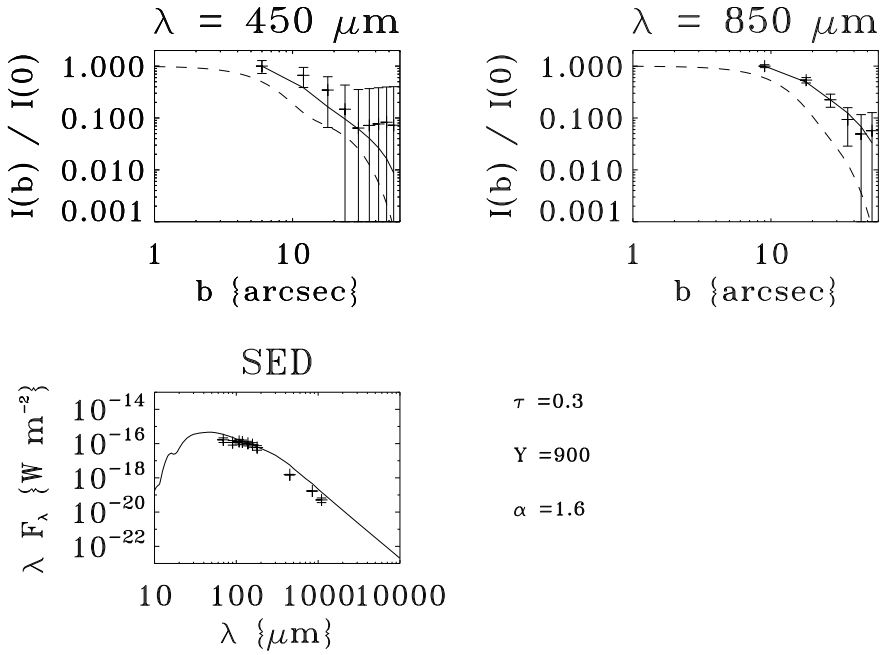

Figure 20.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

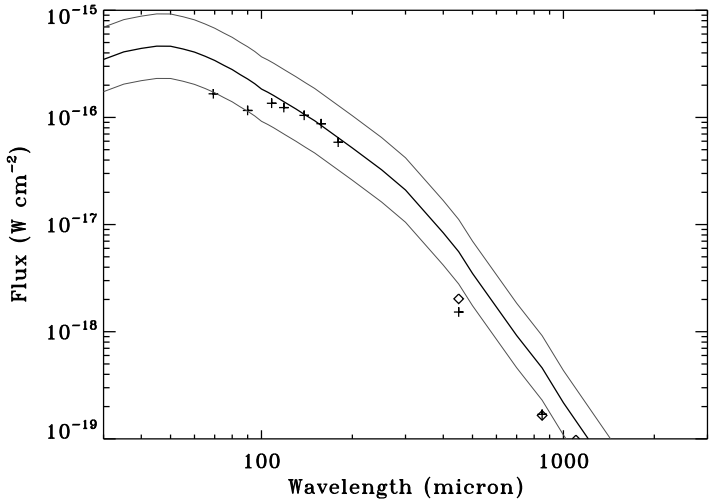

Figure 20.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 21

TMC1A

21.1 Input data: radial profile, luminosity and SED

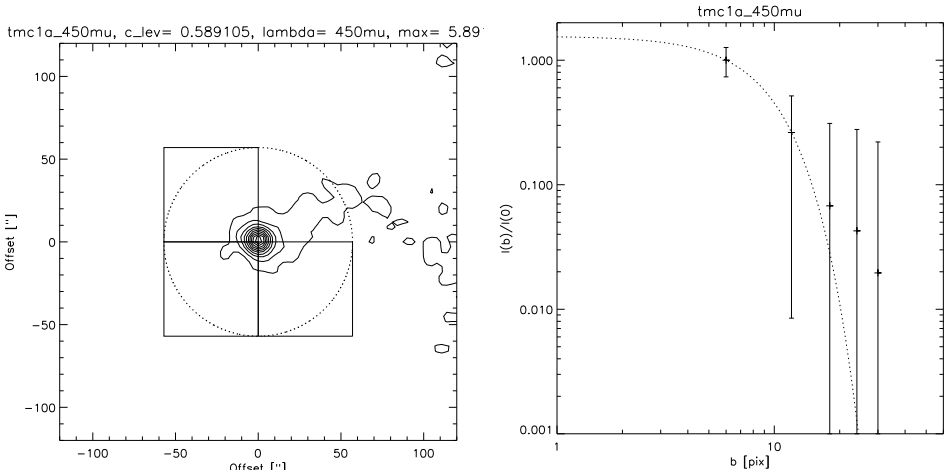

Figure 21.1: Map and radial emission profile of TMC1A at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
tmc1a
=========================
Luminosity =      2.70000
Distance =      140.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

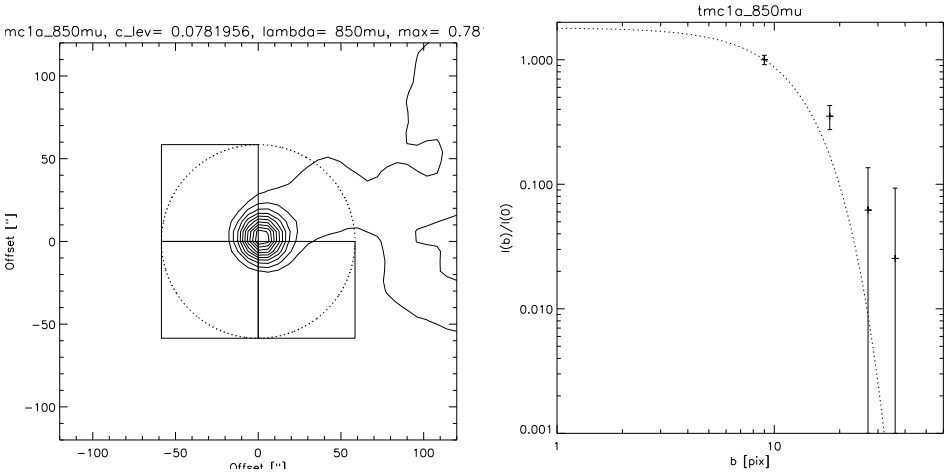

Figure 21.2: Map and radial emission profile of TMC1A at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.49030000
       18.000000       0.31471100
       24.000000       0.22857300
       30.000000       0.16140500
       36.000000       0.11904500
       42.000000      0.097921600
       48.000000      0.075735400
       54.000000      0.065423200

850 mu:
       9.0000000        1.0000000
       18.000000       0.43985800
       27.000000       0.22154900
       36.000000       0.15354300
       45.000000       0.12232100
       54.000000       0.10645900

SED:
       89.990000   8.3842652e-17
       108.07000   9.2689927e-17
       118.58100   8.1109118e-17
       138.52800   6.4470723e-17
```

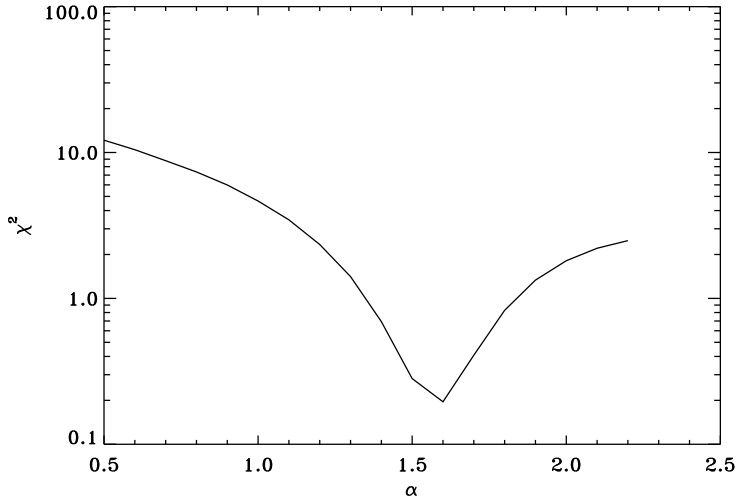

Figure 21.3: Reduced χ^2 as a function of the power-law density slope, α.

```
157.70000   5.2333547e-17
179.52700   2.8023641e-17
450.00000   2.3533334e-18
850.00000   1.6235295e-19
1100.0000   7.3636366e-20
```

All SED points are in units of W m^{-2}.

21.2 χ^2 results

21.2.1 DUSTY parameters

21.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
               r1 [AU] =      7.68
           r(10K) [AU] =  6.72e+03
             ni [cm-3] =  5.24e+08
      n(1000 AU) [cm-3] =  2.17e+05
         n(10 K) [cm-3] =  1.03e+04
     N(H2)(10 K) [cm-2] =  9.87e+22
Envelope mass(10K) [MS] =     0.221
```

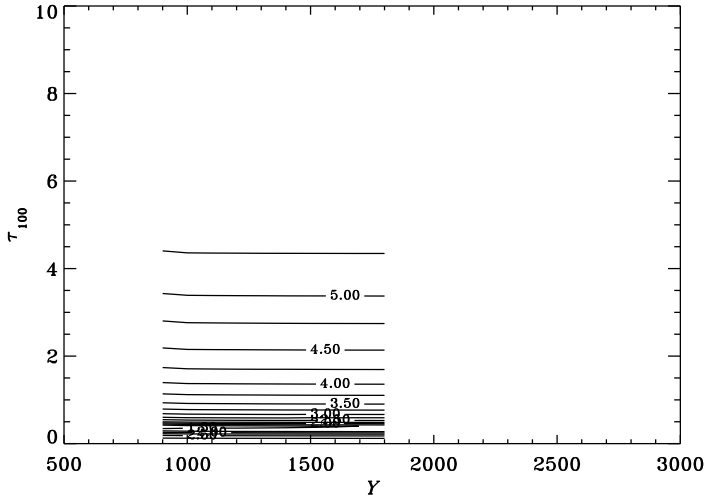

Figure 21.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

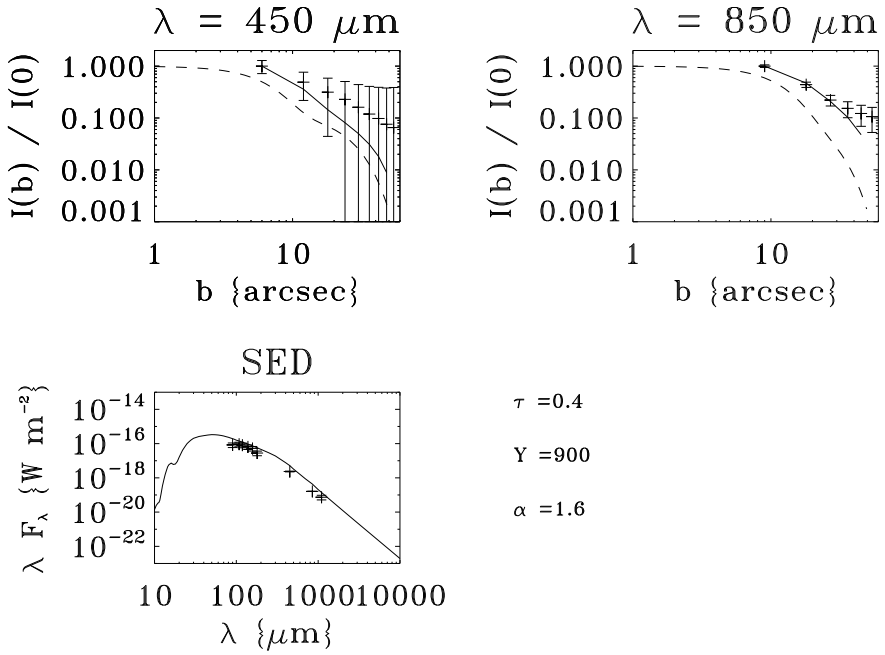

Figure 21.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

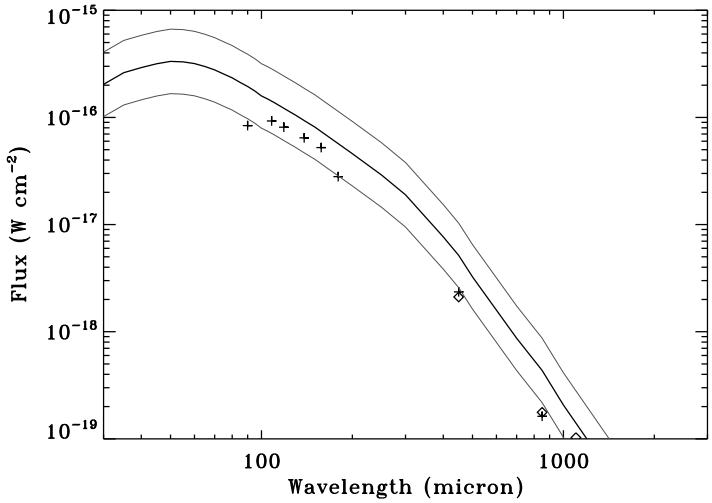

Figure 21.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 22

TMC1

22.1 Input data: radial profile, luminosity and SED

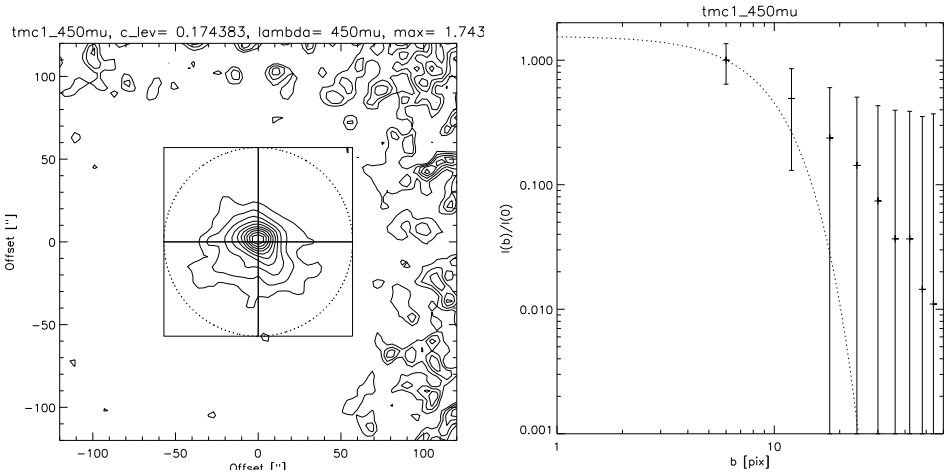

Figure 22.1: Map and radial emission profile of TMC1 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
tmc1
========================
Luminosity =     0.900000
Distance =      140.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

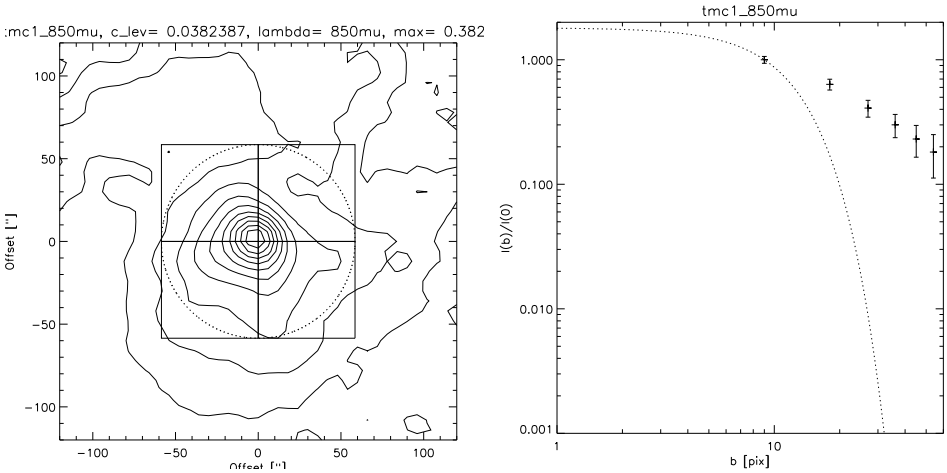

Figure 22.2: Map and radial emission profile of TMC1 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.66674400
       18.000000       0.43612100
       24.000000       0.30941000
       30.000000       0.22563200
       36.000000       0.17997700
       42.000000       0.13075500
       48.000000      0.093453700
       54.000000      0.081107600

850 mu:
       9.0000000        1.0000000
       18.000000       0.63462500
       27.000000       0.40920700
       36.000000       0.30032800
       45.000000       0.23100400
       54.000000       0.18143100

SED:
       69.300000   3.1476192e-17
       89.990000   3.0353374e-17
       108.07000   4.2067180e-17
       118.58100   3.8452199e-17
```

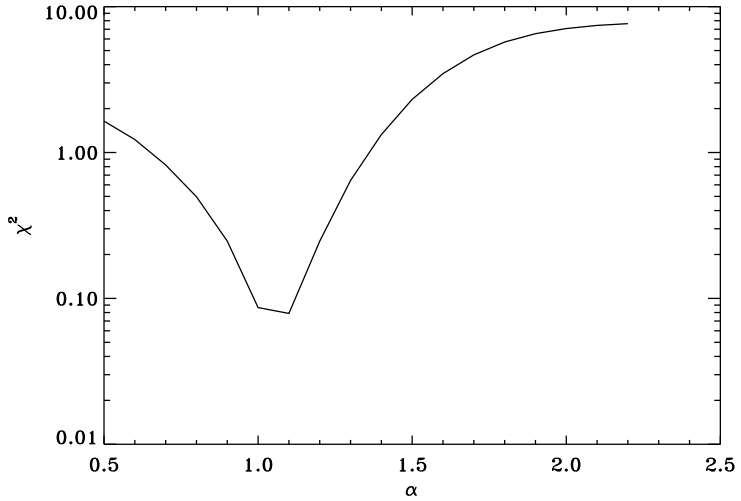

Figure 22.3: Reduced χ^2 as a function of the power-law density slope, α.

```
   138.52800   3.4743158e-17
   157.70000   3.1540902e-17
   179.52700   2.4248721e-17
   450.00000   1.1600000e-18
   850.00000   1.3411765e-19
   1100.0000   3.1636365e-20
```

All SED points are in units of W m^{-2}.

22.2 χ^2 results

22.2.1 DUSTY parameters

22.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
                r1 [AU] =      3.69
            r(10K) [AU] =  5.04e+03
              ni [cm-3] =  8.47e+07
      n(1000 AU) [cm-3] =  1.79e+05
         n(10 K) [cm-3] =  3.02e+04
     N(H2)(10 K) [cm-2] =  2.41e+22
Envelope mass(10K) [MS] =     0.201
```

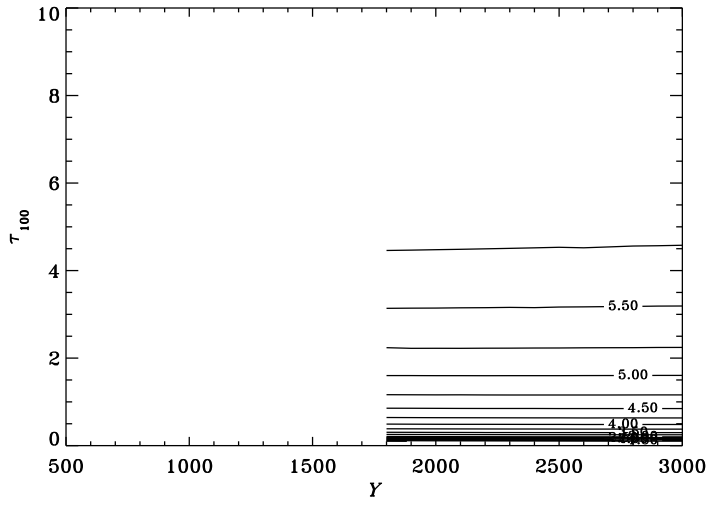

Figure 22.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

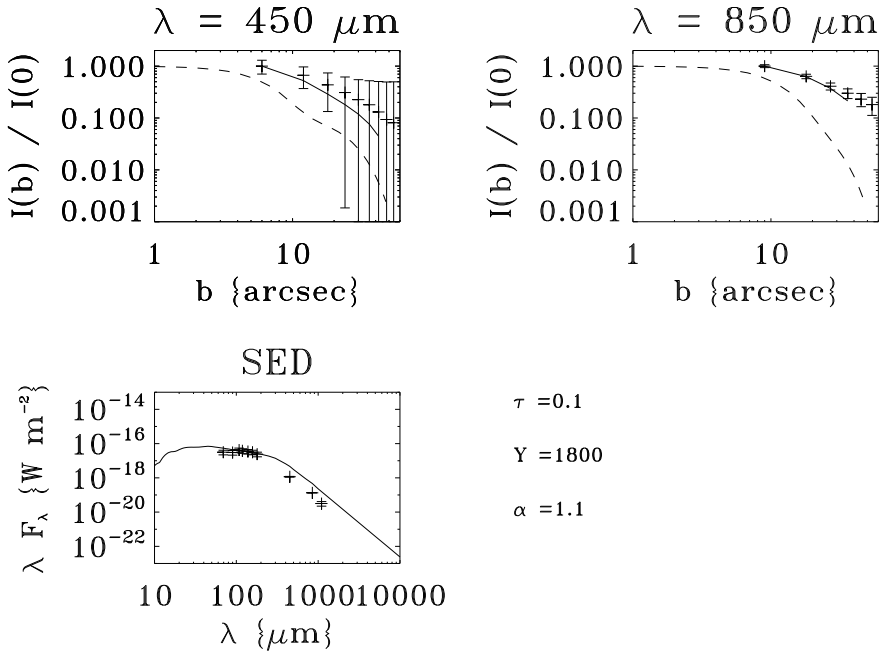

Figure 22.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

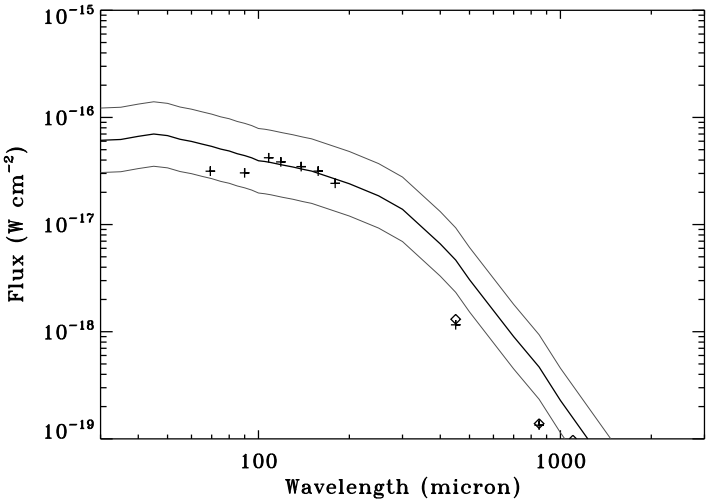

Figure 22.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 23

HH46

23.1 Input data: radial profile, luminosity and SED

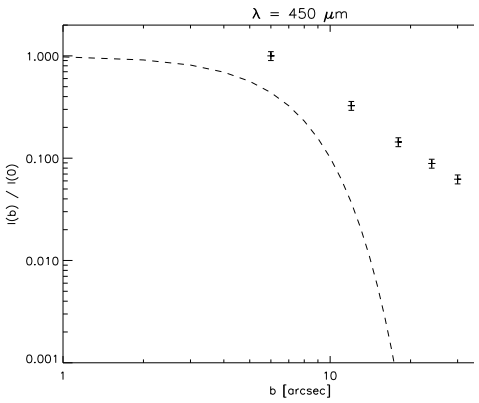

Figure 23.1: Map and radial emission profile of HH46 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
hh46
=========================
Luminosity =      27.9000
Distance =      450.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

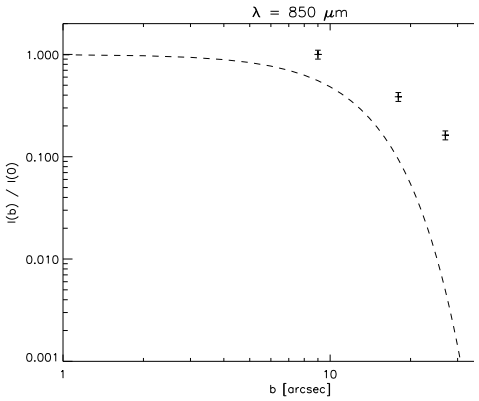

Figure 23.2: Map and radial emission profile of HH46 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
      6.00000      1.00000
      12.0000     0.374156
      18.0000     0.176061
      24.0000     0.111452
      30.0000    0.0784836
      36.0000    0.0582585
      42.0000    0.0448034
      48.0000    0.0352373
      54.0000    0.0271767

850 mu:
       6.0000000       1.0000000
       12.000000      0.66012500
       18.000000      0.34680300
       24.000000      0.15945100
       30.000000     0.091509500
       36.000000     0.068692600
       42.000000     0.061357800
       48.000000     0.057546900

SED:
       69.300000   1.6698702e-16
       89.990000   1.5894767e-16
```

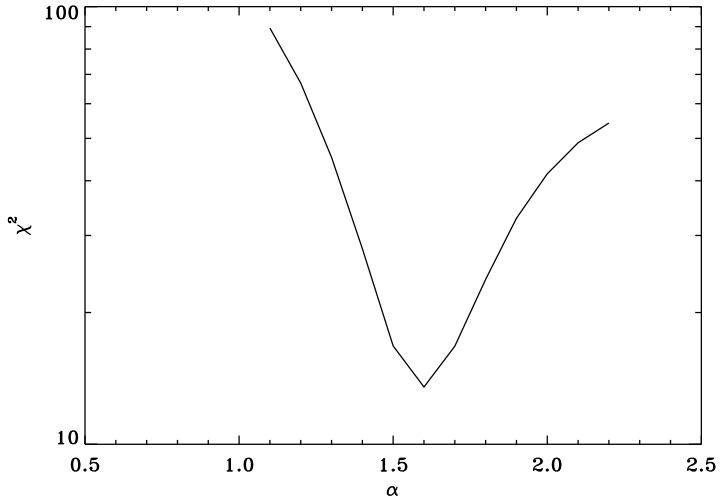

Figure 23.3: Reduced χ^2 as a function of the power-law density slope, α.

```
108.07000   1.8715093e-16
118.58100   1.7108306e-16
138.52800   1.5145098e-16
157.70000   1.3990045e-16
179.52700   1.1271118e-16
450.00000   2.1560001e-17
850.00000   4.1647060e-19
1300.0000   1.7307693e-19
```

All SED points are in units of W m^{-2}.

23.2 χ^2 results

23.2.1 DUSTY parameters

23.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
               r1 [AU] =     28.46
           r(10K) [AU] =  1.68e+04
             ni [cm-3] =  3.54e+08
      n(1000 AU) [cm-3] =  1.19e+06
         n(10 K) [cm-3] =  1.31e+04
     N(H2)(10 K) [cm-2] =  2.46e+23
Envelope mass(10K) [MS] =     4.362
```

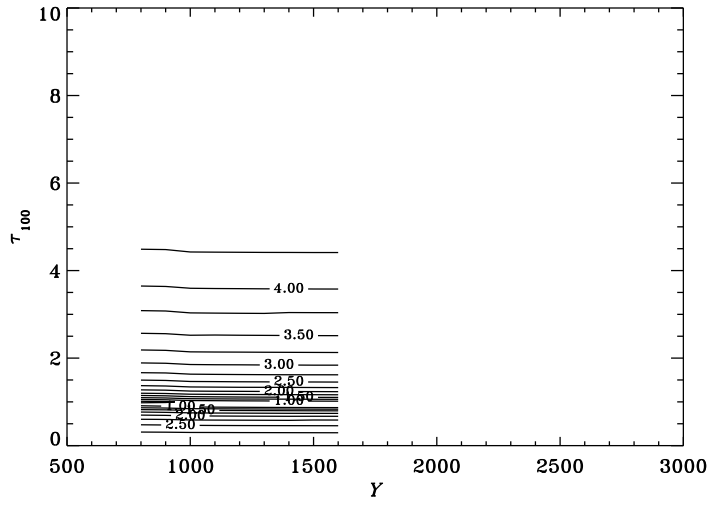

Figure 23.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

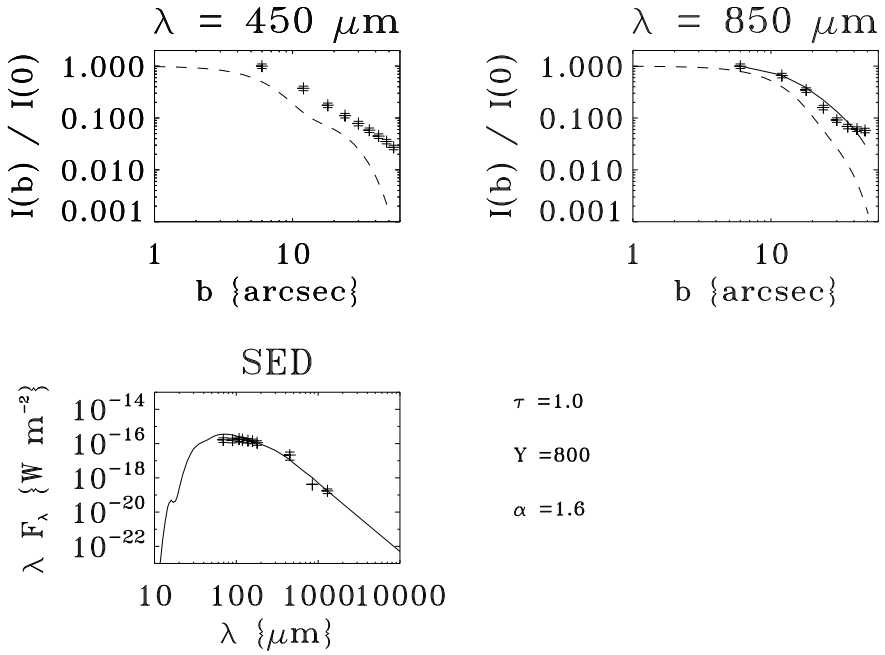

Figure 23.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

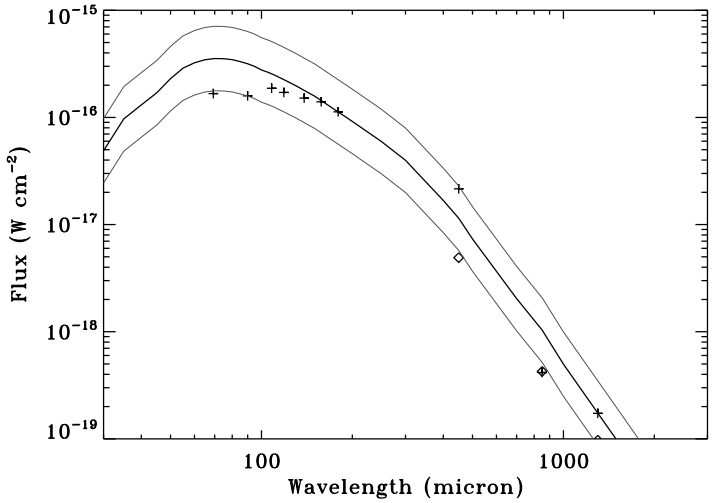

Figure 23.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 24

IRAS12496

24.1 Input data: radial profile, luminosity and SED

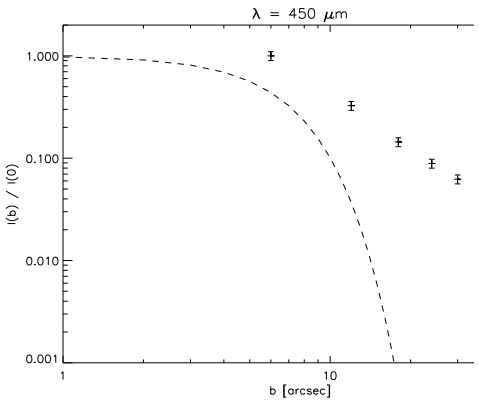

Figure 24.1: Map and radial emission profile of IRAS12496 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
iras12496
=========================
Luminosity =      4.50000
Distance =      178.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

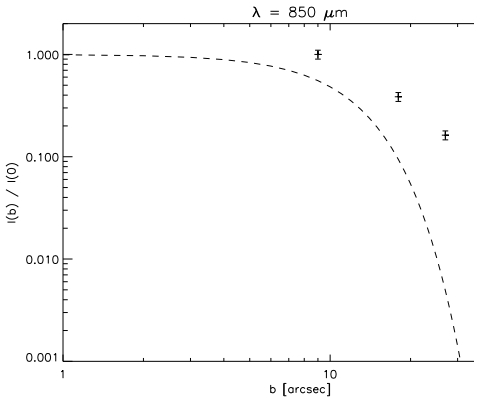

Figure 24.2: Map and radial emission profile of IRAS12496 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
      6.00000       1.00000
      12.0000      0.374156
      18.0000      0.176061
      24.0000      0.111452
      30.0000     0.0784836
      36.0000     0.0582585
      42.0000     0.0448034
      48.0000     0.0352373
      54.0000     0.0271767

850 mu:
      9.00000       1.00000
      18.0000      0.434472
      27.0000      0.195712
      36.0000      0.114433
      45.0000     0.0755125
      54.0000     0.0454798

SED:
       50.000000   6.0000002e-17
       70.000000   1.7142858e-16
       90.000000   2.5998336e-16
       110.00000   2.1771326e-16
```

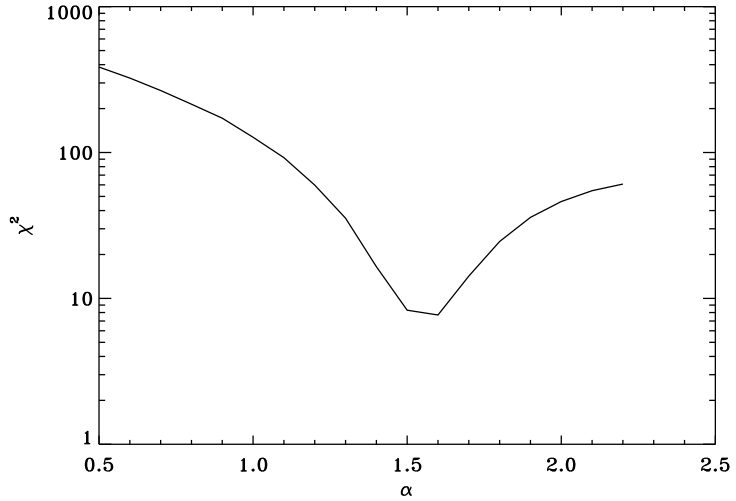

Figure 24.3: Reduced χ^2 as a function of the power-law density slope, α.

```
120.00000   1.8383735e-16
130.00000   1.7010259e-16
140.00000   1.4392941e-16
150.00000   1.2615803e-16
160.00000   1.1210552e-16
170.00000   9.2503761e-17
180.00000   8.2779300e-17
850.00000   5.2941178e-19
1300.0000   7.8461541e-20
```

All SED points are in units of W m^{-2}.

24.2 χ^2 results

24.2.1 DUSTY parameters

24.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
               r1 [AU] =     12.00
           r(10K) [AU] =  6.08e+03
             ni [cm-3] =  1.09e+09
      n(1000 AU) [cm-3] =  9.22e+05
         n(10 K) [cm-3] =  5.13e+04
     N(H2)(10 K) [cm-2] =  3.19e+23
Envelope mass(10K) [MS] =     0.818
```

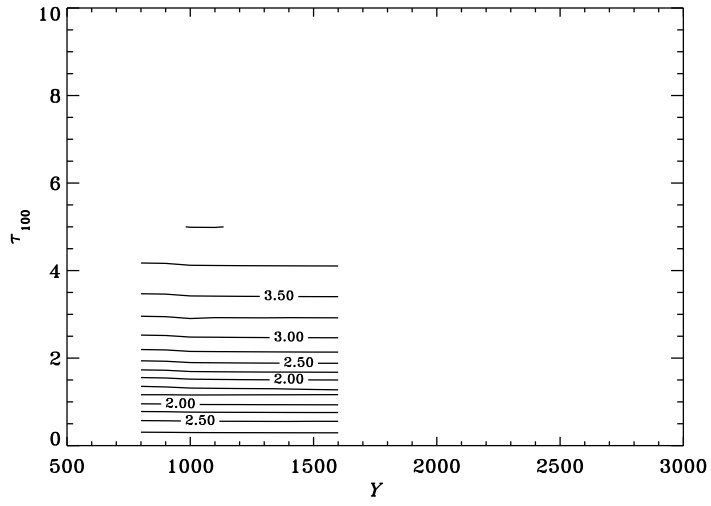

Figure 24.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

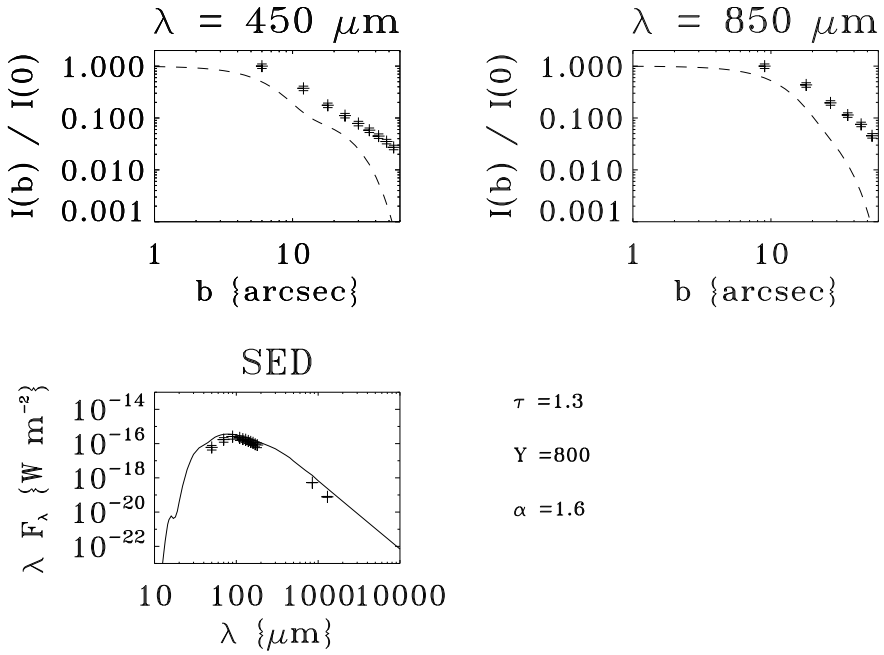

Figure 24.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

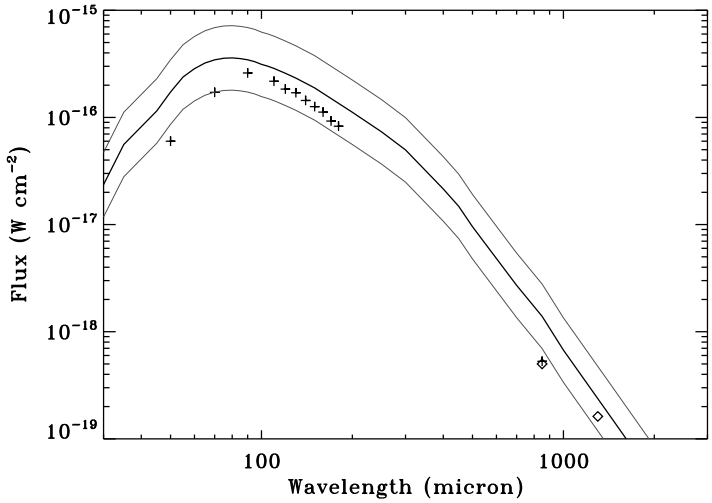

Figure 24.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 25

GSS30-IRS1

25.1 Input data: radial profile, luminosity and SED

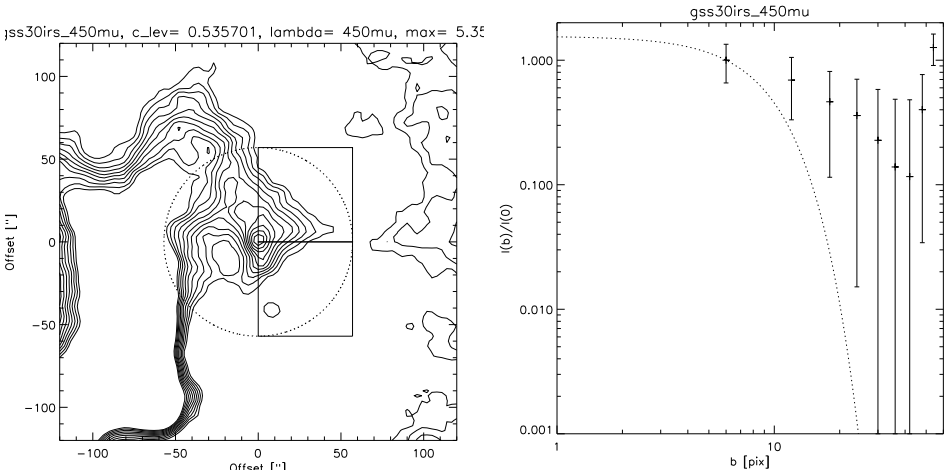

Figure 25.1: Map and radial emission profile of GSS30-IRS1 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
gss30irs
========================
Luminosity =      13.9000
Distance =      125.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

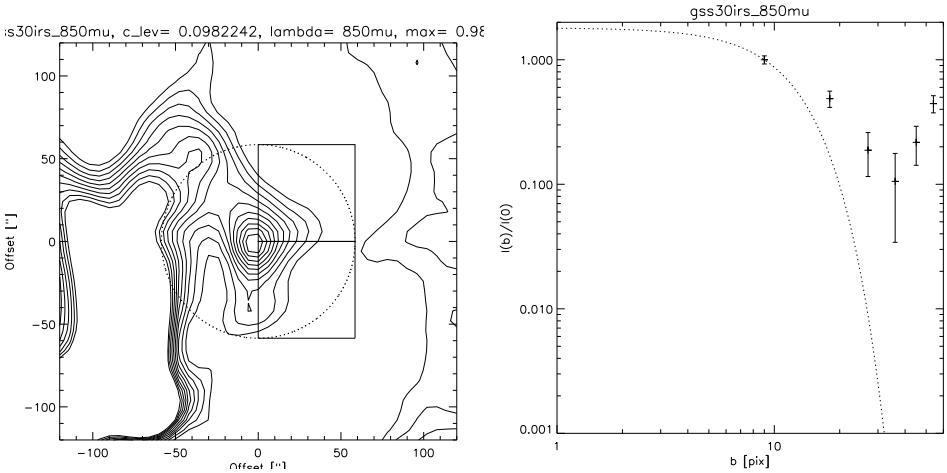

Figure 25.2: Map and radial emission profile of GSS30-IRS1 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.72746600
       18.000000       0.48890200
       24.000000       0.33096700
       30.000000       0.25142600
       36.000000       0.15109200
       42.000000       0.11269700
       48.000000       0.15042100
       54.000000       0.23172000

850 mu:
       9.0000000        1.0000000
       18.000000       0.55260300
       27.000000       0.26545500
       36.000000       0.14972700
       45.000000       0.15867800
       54.000000       0.19000000

SED:
       60.000000   1.2379721e-15
       70.000000   1.2410861e-15
       80.000000   1.1849597e-15
       90.000000   1.1682706e-15
```

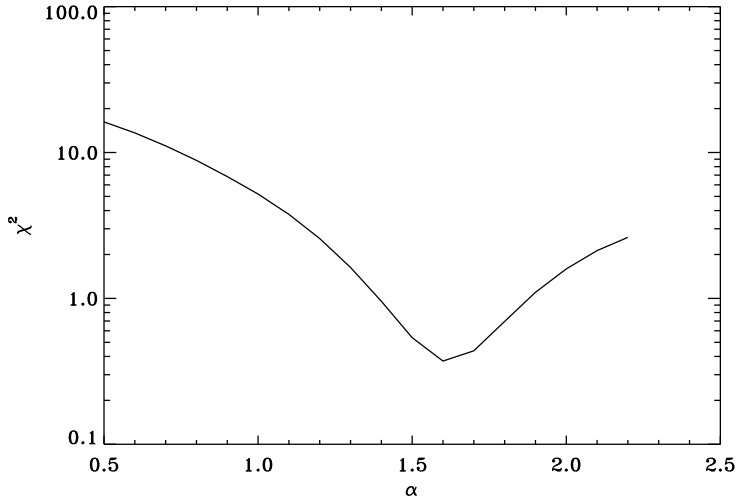

Figure 25.3: Reduced χ^2 as a function of the power-law density slope, α.

```
110.00000   1.0622950e-15
120.00000   9.4218464e-16
130.00000   8.5400745e-16
140.00000   7.5304034e-16
150.00000   6.4350038e-16
160.00000   5.7136024e-16
170.00000   4.6412342e-16
180.00000   3.9378331e-16
450.00000   3.5800001e-18
850.00000   3.4941178e-19
1100.0000   1.0090909e-19
```

All SED points are in units of W m^{-2}.

25.2 χ^2 results

25.2.1 DUSTY parameters

25.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
               r1 [AU] =     16.20
           r(10K) [AU] =  1.62e+04
             ni [cm-3] =  1.24e+08
      n(1000 AU) [cm-3] =  1.69e+05
         n(10 K) [cm-3] =  1.97e+03
     N(H2)(10 K) [cm-2] =  4.93e+22
```

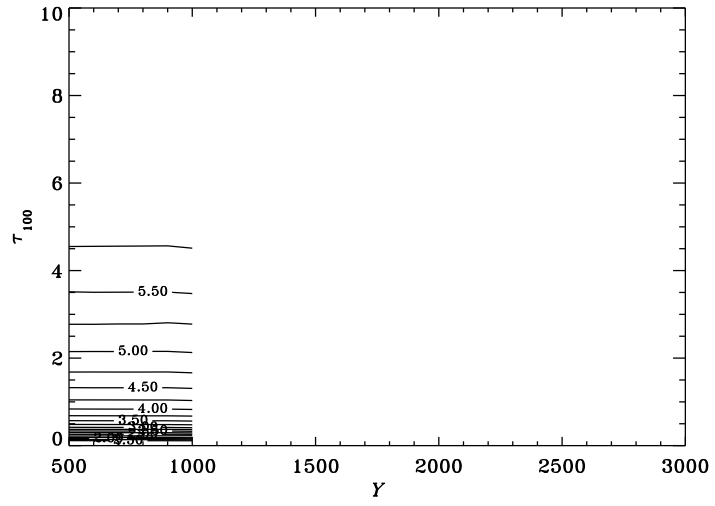

Figure 25.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

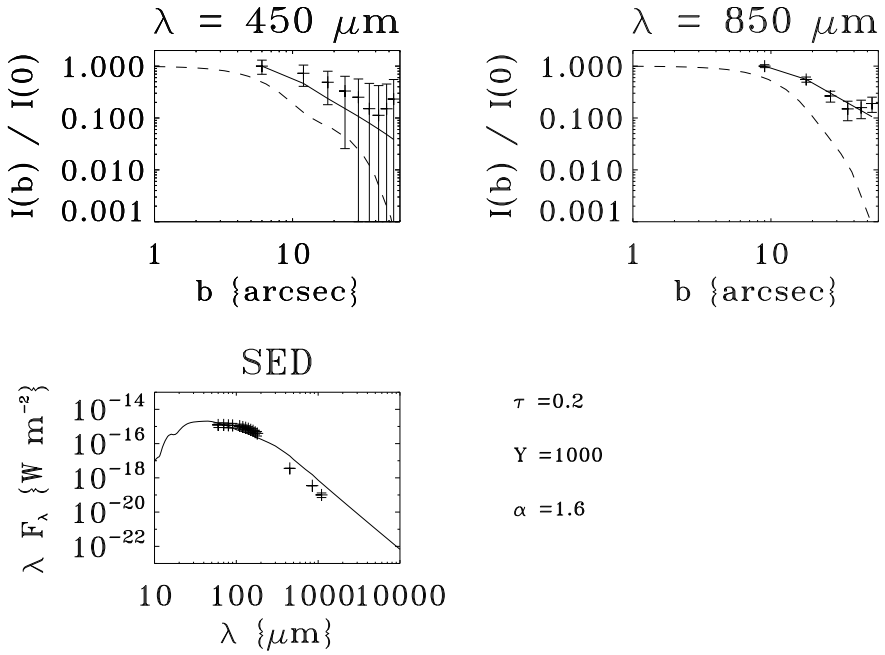

Figure 25.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

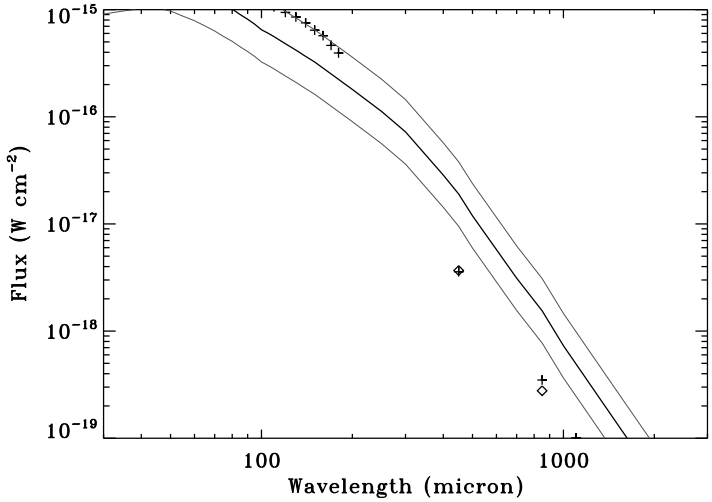

Figure 25.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

```
Envelope mass(10K) [MS] =     0.592
```

Chapter 26

Elias29

26.1 Input data: radial profile, luminosity and SED

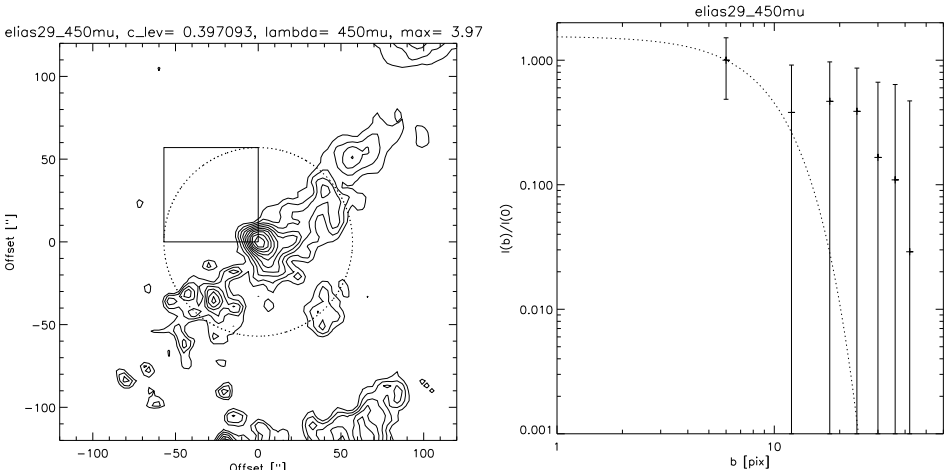

Figure 26.1: Map and radial emission profile of Elias29 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
elias29
========================
Luminosity =      14.1000
Distance =      125.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

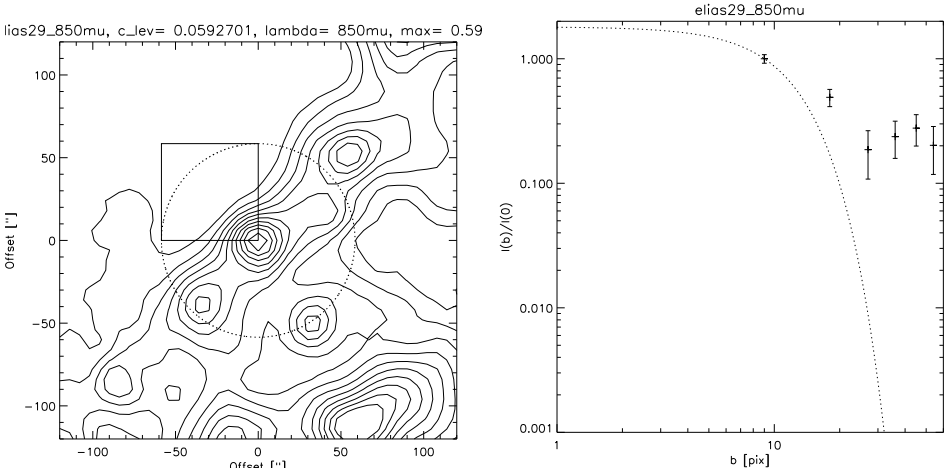

Figure 26.2: Map and radial emission profile of Elias29 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.56486000
       18.000000       0.23429800
       24.000000       0.13373300
       30.000000       0.27965700
       36.000000       0.19768800
       42.000000       0.15183700
       48.000000       0.11038800
       54.000000       0.10461000

850 mu:
       9.0000000        1.0000000
       18.000000       0.58426200
       27.000000       0.29484200
       36.000000       0.17594100
       45.000000       0.12994400
       54.000000       0.11684600

SED:
       60.000000   9.4369149e-16
       70.000000   8.3547359e-16
       80.000000   7.4152447e-16
       90.000000   7.0930536e-16
```

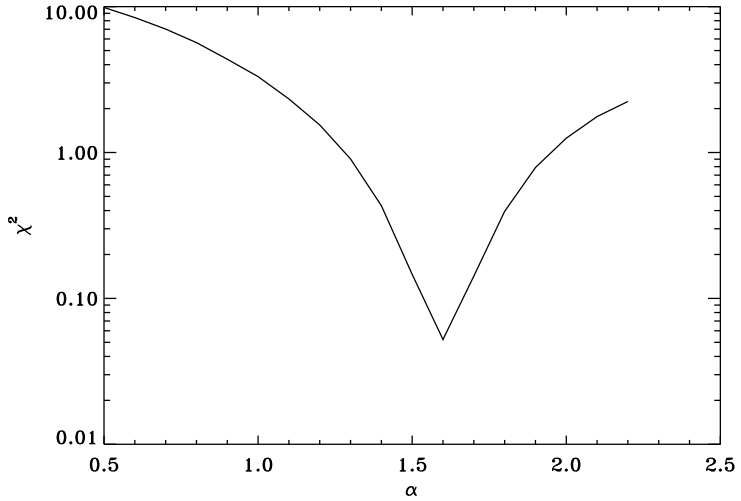

Figure 26.3: Reduced χ^2 as a function of the power-law density slope, α.

```
110.00000   6.0078379e-16
120.00000   5.2540699e-16
130.00000   4.7063639e-16
140.00000   4.1364565e-16
150.00000   3.5051079e-16
160.00000   3.1329106e-16
170.00000   2.5108474e-16
180.00000   2.1648054e-16
450.00000   2.6466668e-18
850.00000   2.0823530e-19
1100.0000   7.0909094e-20
```

All SED points are in units of W m^{-2}.

26.2 χ^2 results

26.2.1 DUSTY parameters

26.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
               r1 [AU] =     15.49
           r(10K) [AU] =  1.55e+04
             ni [cm-3] =  6.49e+07
      n(1000 AU) [cm-3] =  8.25e+04
         n(10 K) [cm-3] =  1.03e+03
     N(H2)(10 K) [cm-2] =  2.47e+22
```

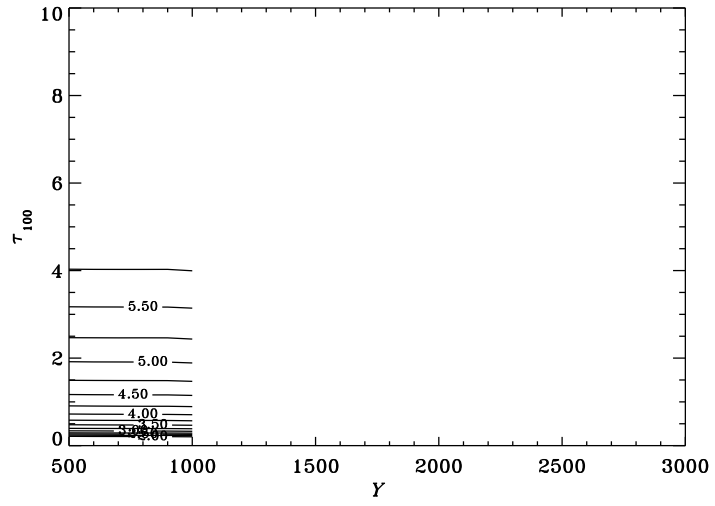

Figure 26.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

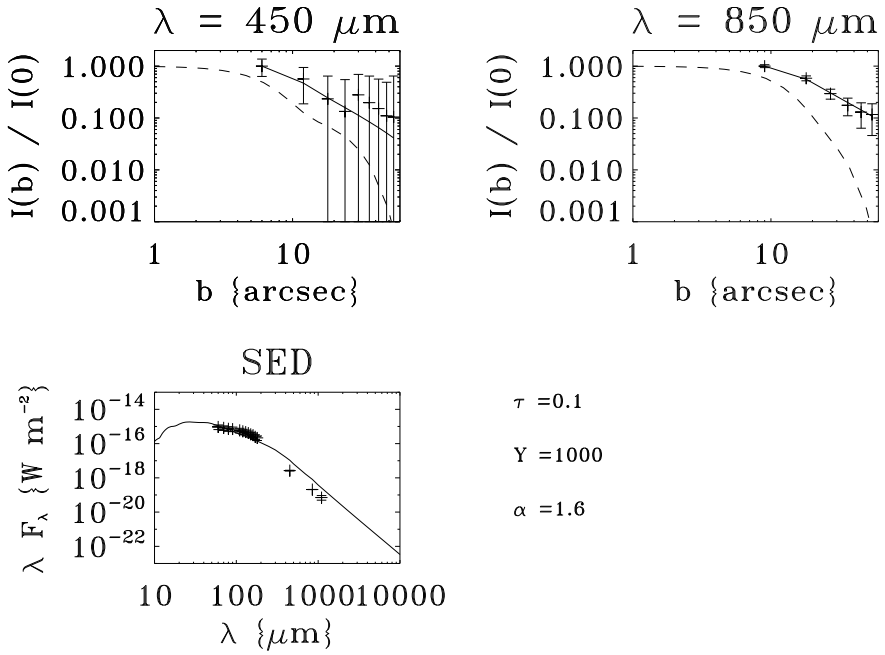

Figure 26.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

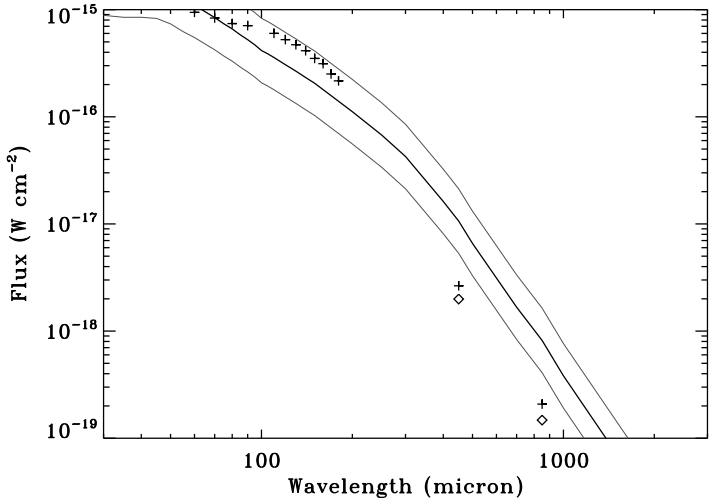

Figure 26.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

```
Envelope mass(10K) [MS] =     0.271
```

Chapter 27

Oph-IRS63

27.1 Input data: radial profile, luminosity and SED

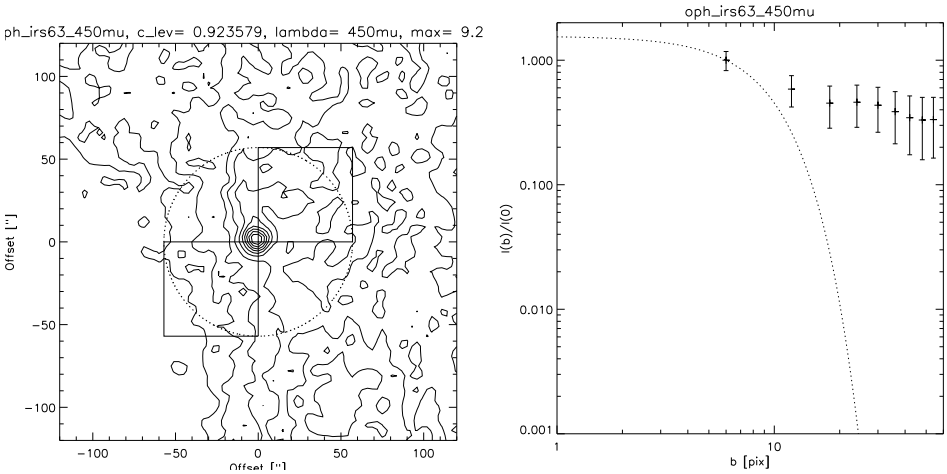

Figure 27.1: Map and radial emission profile of Oph-IRS63 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
oph_irs63
=========================
Luminosity =      1.30000
Distance =      125.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

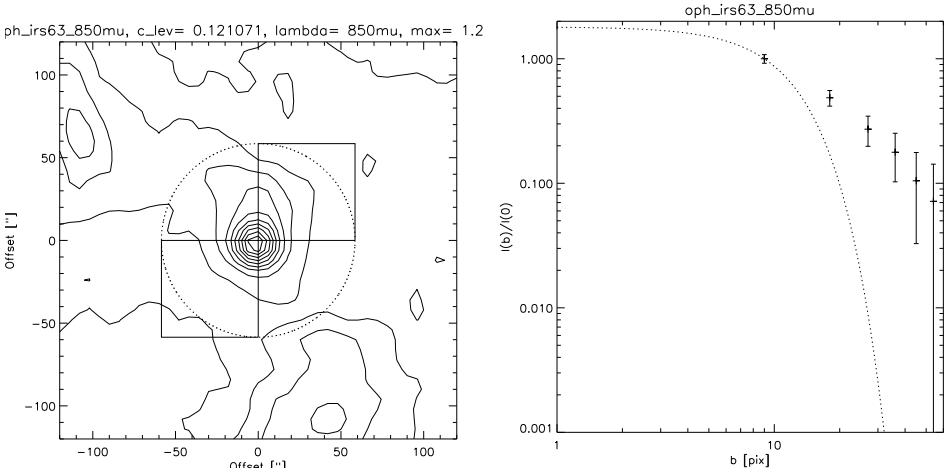

Figure 27.2: Map and radial emission profile of Oph-IRS63 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.42619500
       18.000000       0.31671300
       24.000000       0.38334600
       30.000000       0.40855000
       36.000000       0.36817300
       42.000000       0.29386600
       48.000000       0.24500700
       54.000000       0.21762700

850 mu:
       9.0000000        1.0000000
       18.000000       0.41340100
       27.000000       0.16878600
       36.000000       0.10726000
       45.000000      0.060274200
       54.000000      0.019763400

SED:
       60.000000   7.3242713e-17
       70.000000   6.8682058e-17
       80.000000   5.6733242e-17
       90.000000   6.3656929e-17
```

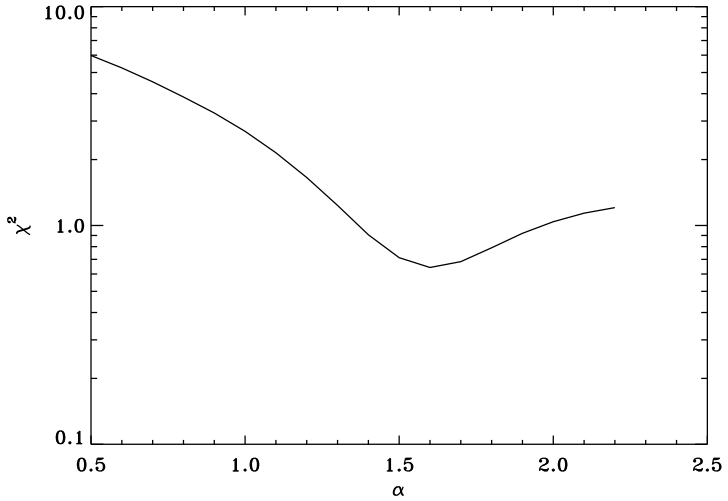

Figure 27.3: Reduced χ^2 as a function of the power-law density slope, α.

```
110.00000   6.5461072e-17
120.00000   6.0662200e-17
130.00000   6.2831132e-17
140.00000   6.2835499e-17
150.00000   5.6251750e-17
160.00000   5.7072394e-17
170.00000   5.2062898e-17
180.00000   5.1031397e-17
450.00000   6.1466669e-18
850.00000   4.3058825e-19
1100.0000   1.2518182e-19
```

All SED points are in units of W m^{-2}.

27.2 χ^2 results

27.2.1 DUSTY parameters

27.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
               r1 [AU] =      6.55
           r(10K) [AU] =  3.18e+03
             ni [cm-3] =  2.15e+09
     n(1000 AU) [cm-3] =  6.90e+05
        n(10 K) [cm-3] =  1.09e+05
    N(H2)(10 K) [cm-2] =  3.43e+23
```

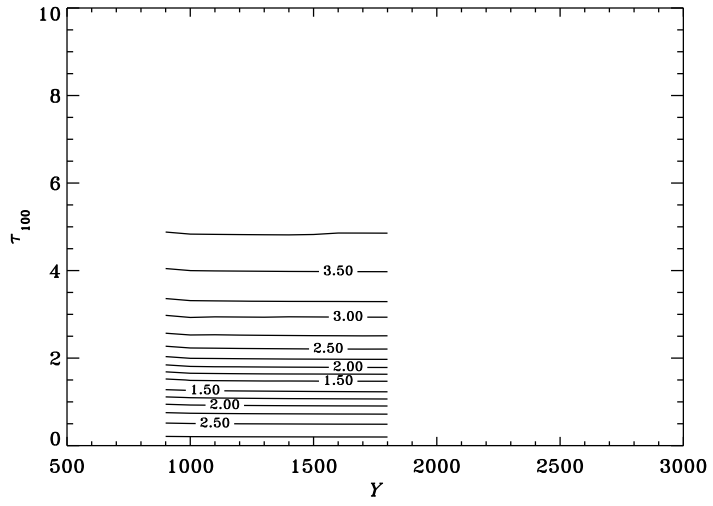

Figure 27.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

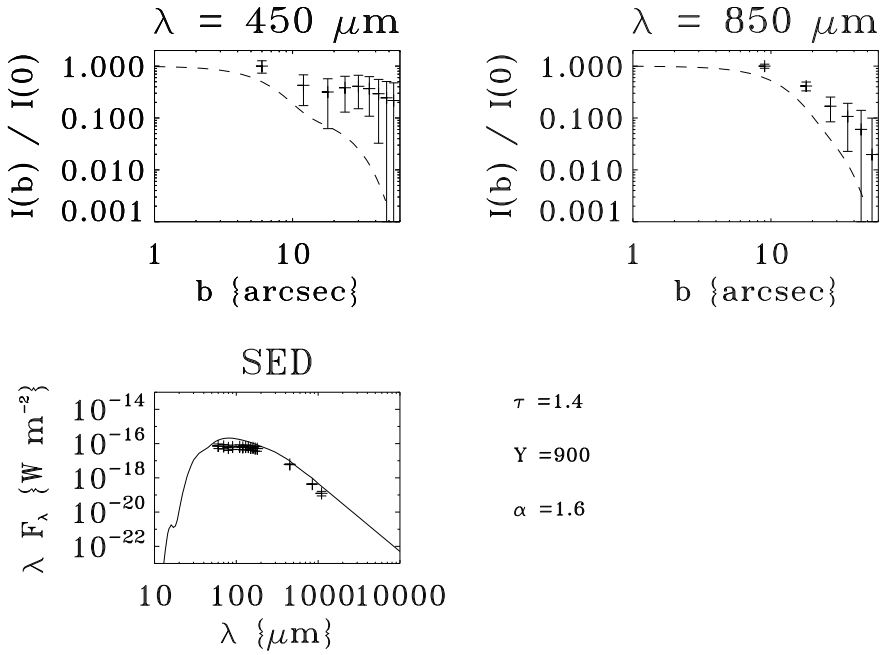

Figure 27.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

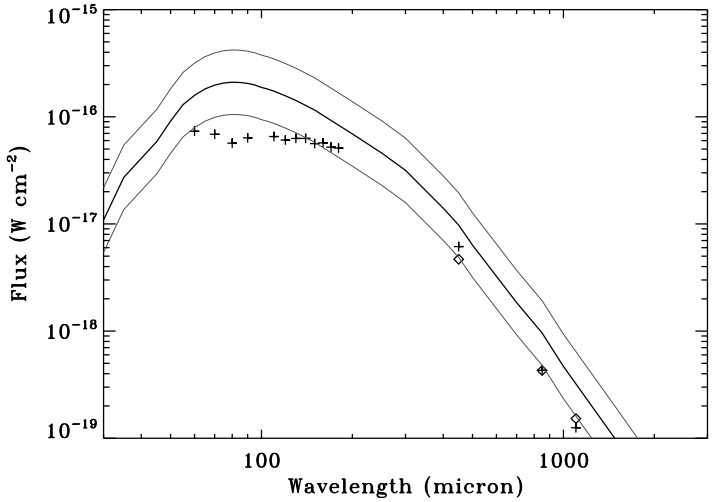

Figure 27.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

```
Envelope mass(10K) [MS] =     0.246
```

Chapter 28

RNO91

28.1 Input data: radial profile, luminosity and SED

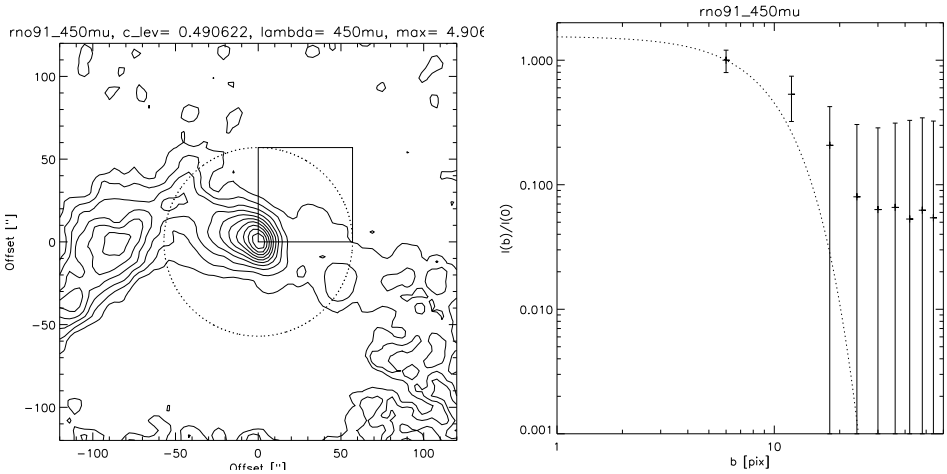

Figure 28.1: Map and radial emission profile of RNO91 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
rno91
=========================
Luminosity =      2.60000
Distance =      125.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

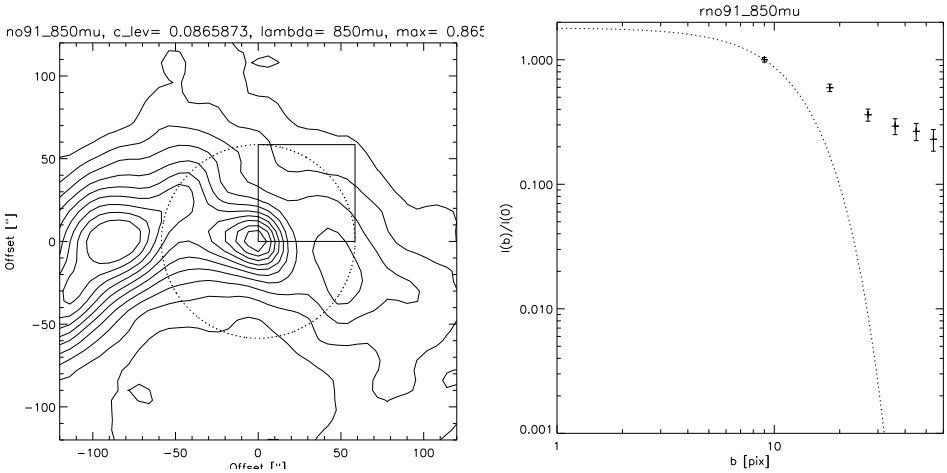

Figure 28.2: Map and radial emission profile of RNO91 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.66690800
       18.000000       0.34614400
       24.000000       0.17467800
       30.000000       0.10522200
       36.000000      0.093976100
       42.000000       0.10182500
       48.000000      0.091804500
       54.000000      0.072584100

850 mu:
       9.0000000        1.0000000
       18.000000       0.59609100
       27.000000       0.36160100
       36.000000       0.29317300
       45.000000       0.26628000
       54.000000       0.22982700

SED:
       69.300000   1.8038962e-16
       89.990000   1.6798200e-16
       108.07000   1.9161748e-16
       118.58100   1.7848560e-16
```

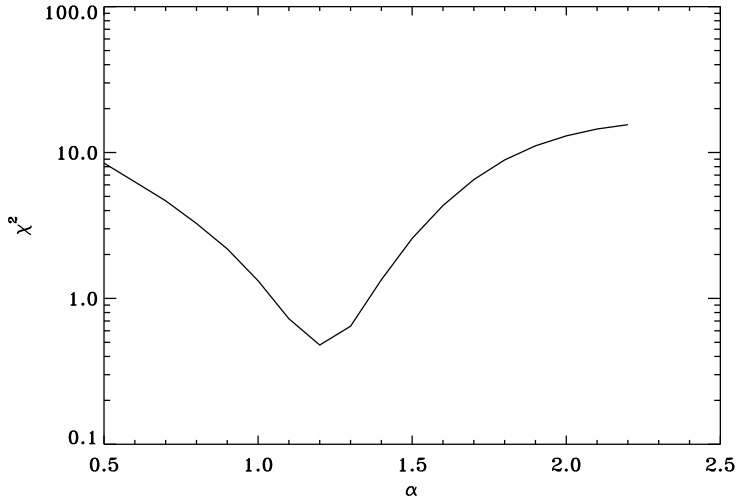

Figure 28.3: Reduced χ^2 as a function of the power-law density slope, α.

```
138.52800   1.5392629e-16
157.70000   1.3259544e-16
179.52700   9.6135961e-17
450.00000   3.2666668e-18
850.00000   3.0352942e-19
1300.0000   2.0769232e-20
```

All SED points are in units of W m^{-2}.

28.2 χ^2 results

28.2.1 DUSTY parameters

28.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
                r1 [AU] =      6.63
           r(10K) [AU] =  5.97e+03
             ni [cm-3] =  1.34e+08
      n(1000 AU) [cm-3] =  3.25e+05
         n(10 K) [cm-3] =  3.82e+04
     N(H2)(10 K) [cm-2] =  4.93e+22
Envelope mass(10K) [MS] =     0.446
```

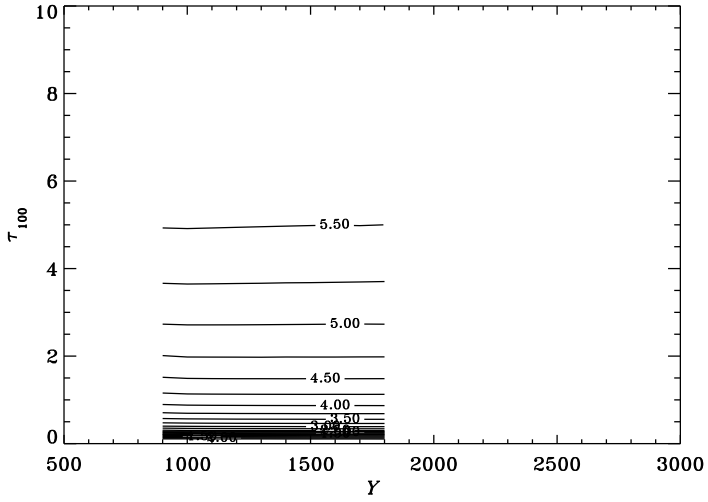

Figure 28.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

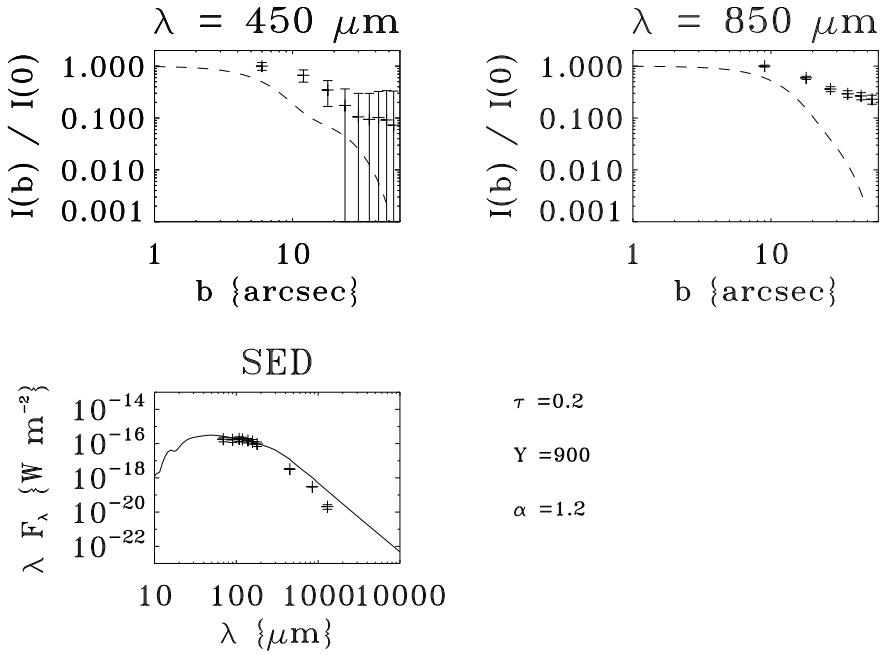

Figure 28.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

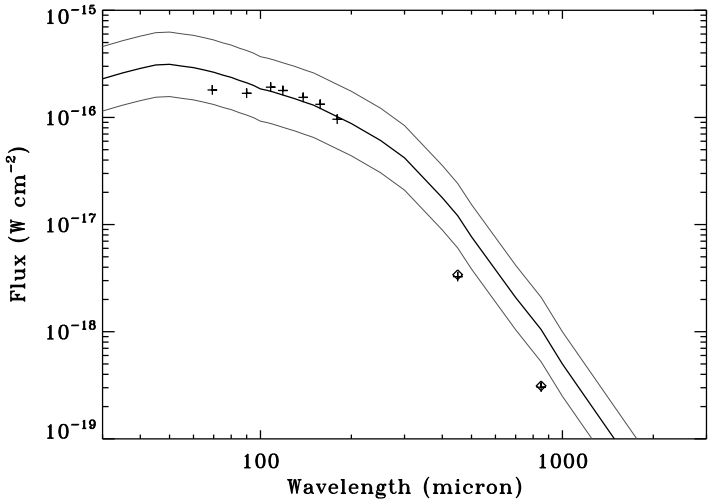

Figure 28.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

Chapter 29

RCrA-IRS5

29.1 Input data: radial profile, luminosity and SED

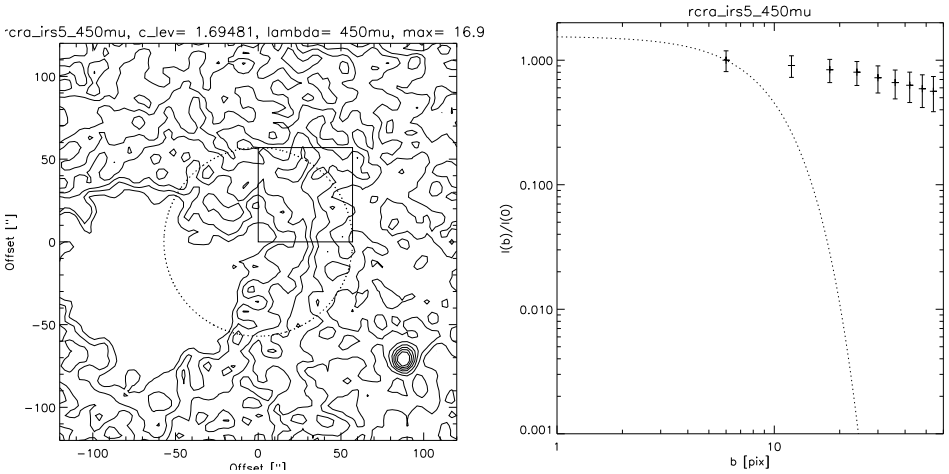

Figure 29.1: Map and radial emission profile of RCrA-IRS5 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
rcra_irs5
=========================
Luminosity =      7.10000
Distance =      170.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

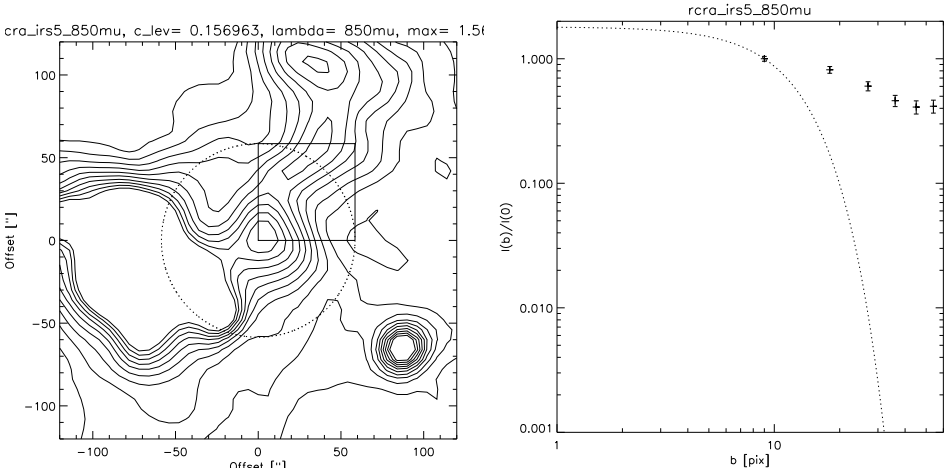

Figure 29.2: Map and radial emission profile of RCrA-IRS5 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.98639200
       18.000000       0.80225100
       24.000000       0.65473000
       30.000000       0.57427300
       36.000000       0.37427600
       42.000000       0.27798200
       48.000000       0.35481000
       54.000000       0.37272400

850 mu:
       9.0000000        1.0000000
       18.000000       0.78542100
       27.000000       0.53852800
       36.000000       0.38239000
       45.000000       0.44143300
       54.000000       0.43338300

SED:
       60.000000   1.9387792e-16
       70.000000   2.3645139e-16
       80.000000   2.6335334e-16
       90.000000   3.1194703e-16
```

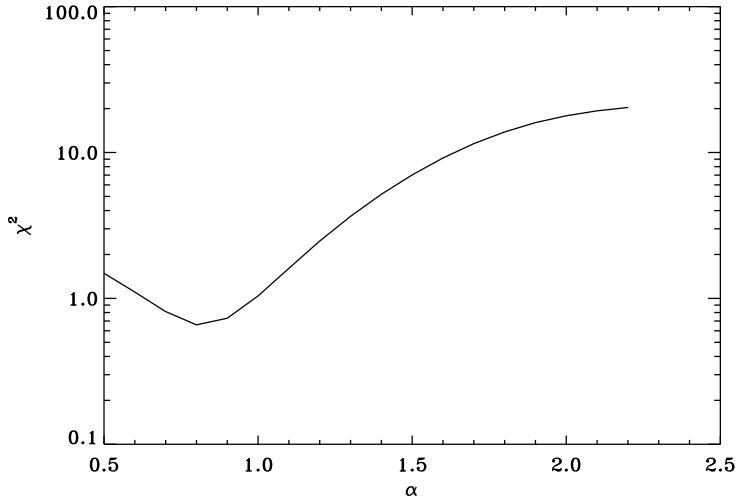

Figure 29.3: Reduced χ^2 as a function of the power-law density slope, α.

```
110.00000   4.3240941e-16
120.00000   4.3418699e-16
130.00000   4.4289982e-16
140.00000   4.3145830e-16
150.00000   4.0240962e-16
160.00000   3.8988240e-16
170.00000   3.4353981e-16
180.00000   3.1587443e-16
450.00000   1.3420001e-17
850.00000   5.5764708e-19
1300.0000   1.8946155e-19
```

All SED points are in units of W m^{-2}.

29.2 χ^2 results

29.2.1 DUSTY parameters

29.2.2 Envelope properties

```
---------------------------------------
Best fit model results are:
               r1 [AU] =     10.05
           r(10K) [AU] =  1.00e+04
             ni [cm-3] =  1.10e+07
     n(1000 AU) [cm-3] =  2.78e+05
        n(10 K) [cm-3] =  4.39e+04
    N(H2)(10 K) [cm-2] =  2.47e+22
```

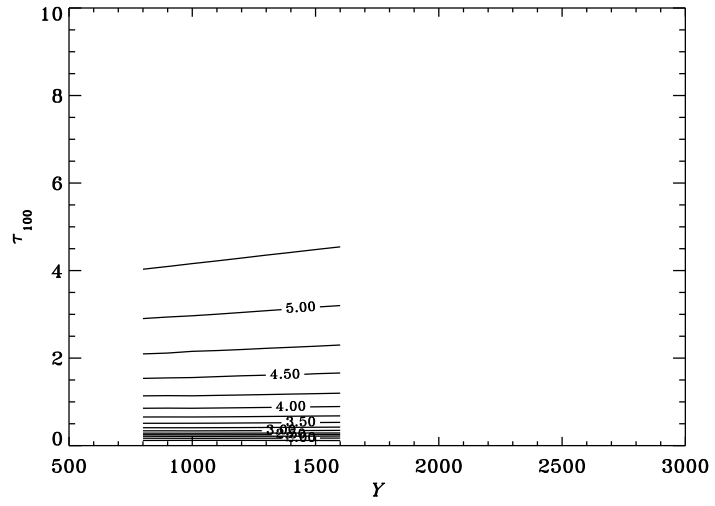

Figure 29.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

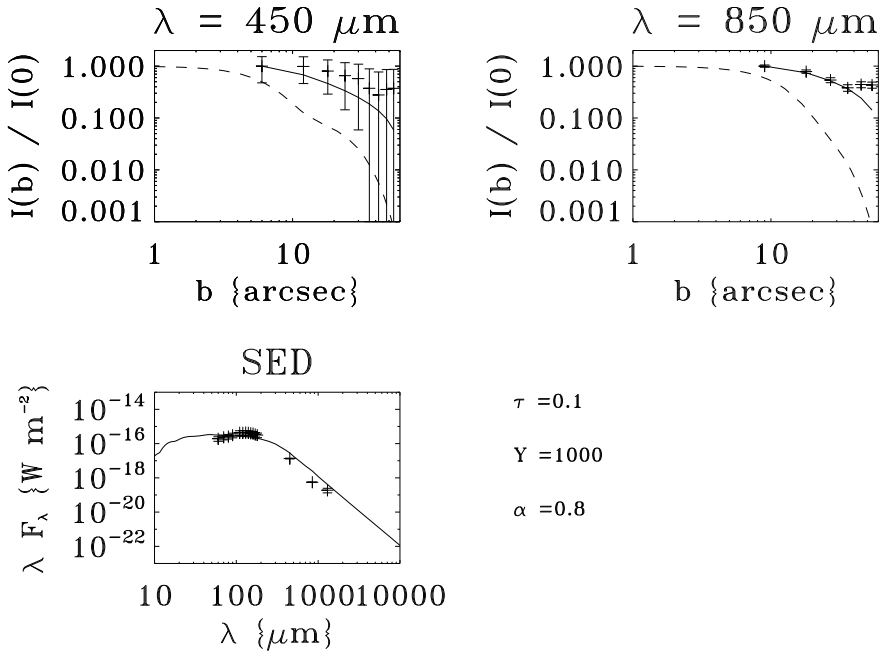

Figure 29.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

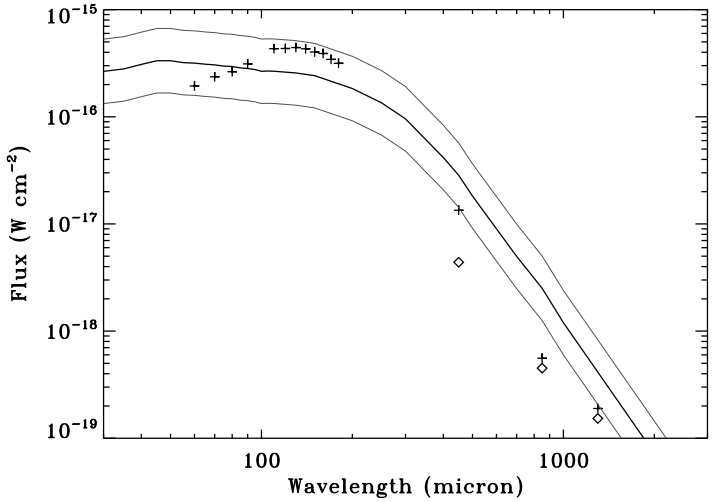

Figure 29.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

```
Envelope mass(10K) [MS] =     2.003
```

Chapter 30

HH100

30.1 Input data: radial profile, luminosity and SED

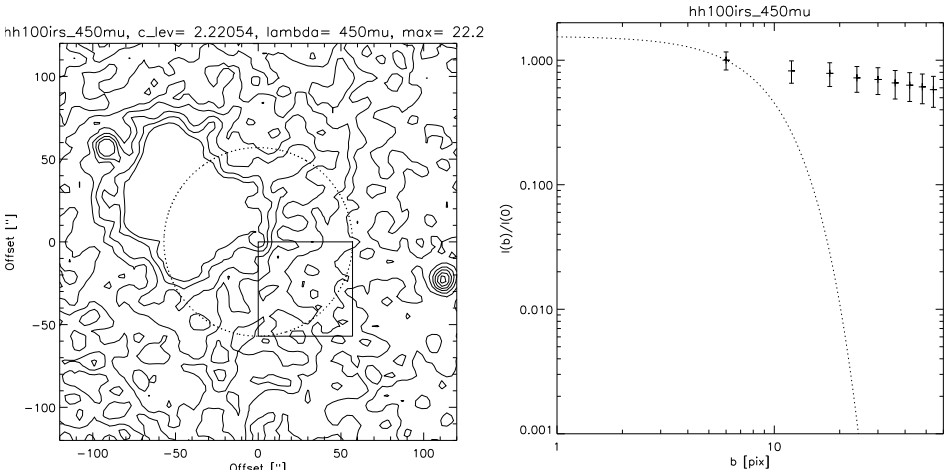

Figure 30.1: Map and radial emission profile of HH100 at 450 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point.

```
hh100irs
=========================
Luminosity =      17.7000
Distance =      170.000

Dusty dir =/data1/kristensen/home/scuba/dusty/results/

Profiles
```

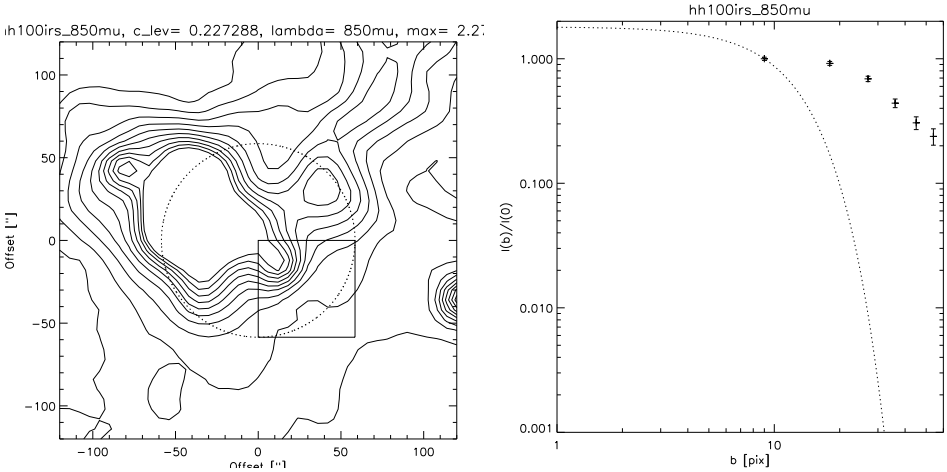

Figure 30.2: Map and radial emission profile of HH100 at 850 μm. Squares show the quadrants that have been included in the radial profile analysis. The dotted circle has a radius of 60″, the outer limit of the radial profile. Contours start at 0 and progress in steps of one-tenth the maximum brightness. The dotted line in the radial profile shows the beam normalized to the first point (the error beam is not shown here).

```
==========
450 mu:
       6.0000000        1.0000000
       12.000000       0.61858900
       18.000000       0.49984300
       24.000000       0.29025400
       30.000000       0.35791500
       36.000000       0.42649100
       42.000000       0.38915600
       48.000000       0.70863300
       54.000000       0.44900400

850 mu:
       9.0000000        1.0000000
       18.000000       0.77765500
       27.000000        1.0350200
       36.000000        1.1555500
       45.000000        1.6665100
       54.000000        2.3861600

SED:
       60.000000   7.0000003e-16
       450.00000   1.6160001e-17
       850.00000   8.0117650e-19
       1300.0000   7.7076926e-20
```

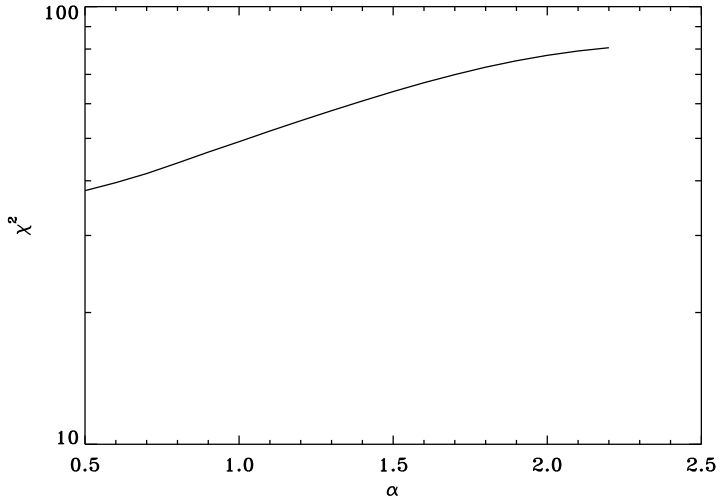

Figure 30.3: Reduced χ^2 as a function of the power-law density slope, α.

All SED points are in units of W m^{-2}.

30.2 χ^2 results

30.2.1 DUSTY parameters

30.2.2 Envelope properties

```
----------------------------------------
Best fit model results are:
                r1 [AU] =     15.52
            r(10K) [AU] =  1.55e+04
              ni [cm-3] =  1.73e+06
      n(1000 AU) [cm-3] =  2.16e+05
         n(10 K) [cm-3] =  5.49e+04
     N(H2)(10 K) [cm-2] =  2.47e+22
Envelope mass(10K) [MS] =     8.136
```

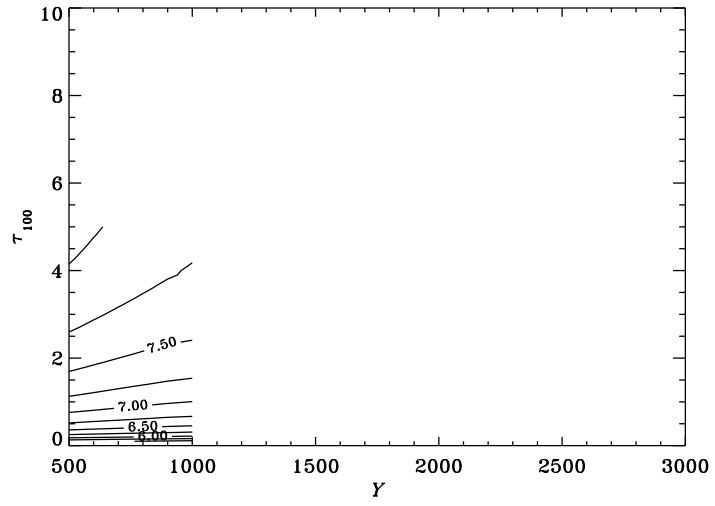

Figure 30.4: χ^2 contours as a function of τ_{100} and Y. The contours are logarithmically spaced by 0.25 dex. The absolute values of the reduced χ^2 are meaningless because the uncertainty on the SCUBA points is taken as 1%.

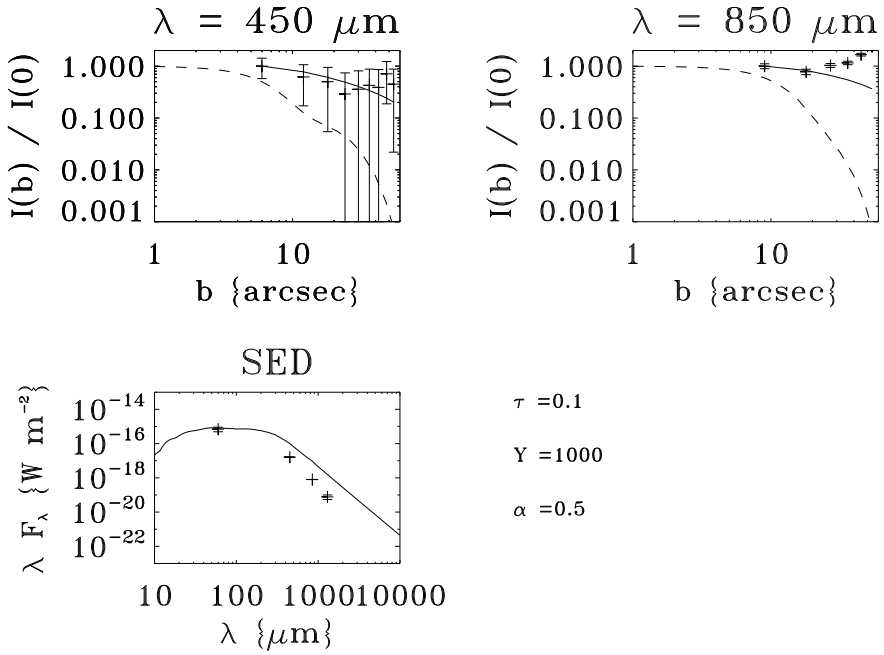

Figure 30.5: Best fit model results overplotted on data. Note that the 450 and 850 μm are intentionally underproduced; see the following figure for a blow-up and explanation.

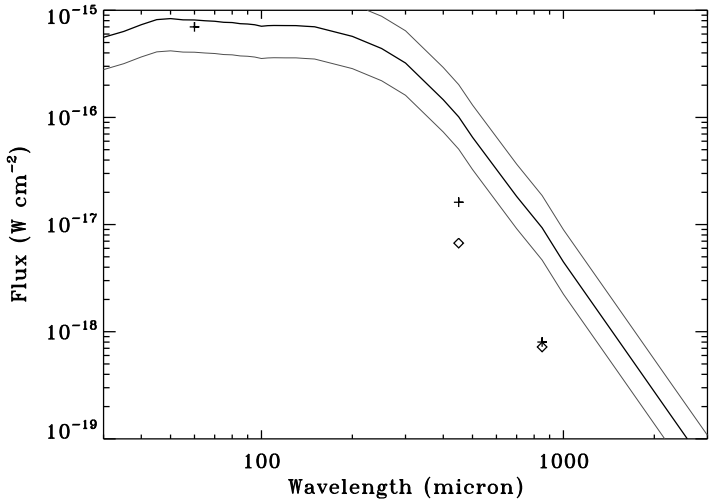

Figure 30.6: Blow-up of the SED. The full thick line is the best-fit DUSTY SED and the two thin lines show the SED plus and minus a factor of 2. The diamonds are for the flux at 450, 850 and 1100 μm extracted in the relevant beams. Crosses show observations.

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