<u>First chi2 analysis for IC348 data from 2007</u>

May 22, 2009

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<u>The data set:</u>

27 data files were collected during a single night in Nov. 2007. Six of these files were rejected due to problems with the chopper: either very low and variable efficiency or throw/nod mismatch. The chopper throw was five arcminutes. One file was rejected because it seemed to make the background rejection in *sharpcombine* complain. This left 20 good files. The *tau* averaged around 0.040-0.045. Tristan did a quick analysis about a year ago, producing results roughly consistent with what I show here.

<u>Analysis steps:</u>

Looking at all the *sharpinteg* Q/U maps reveals very low level problems similar to those described in my recent May 14th L1527 memo. At least some of this seems to be correlated electronic noise. But these problems are at a very low level, much lower than seen in the Sept. 2008 L1527 data.

I used the posted RGM file and the following flags:

sharpinteg: -f 1 -em -w -sil

sharpcombine: -hwp 91 -l 51 51 -sm 2 -ma 5 -ps 9.5 -pm 12.0

-bg 10 0 -ip 0.0034 0.00017 0.0036 0.0

I implemented pointing corrections using fitgauss. I did not find any posted smoothed tau, but the tau written in the excel logs seemed very stable so I just used a single value of "smoothed tau" for all files. (I used 0.042.)

In this memo, just as in the May 14th memo, when I report χ_r^2 results these are the result of averaging map-wide results for Q and U.

Dependence of reduced chi-squared on time scale:

I divided the 20 files into six bins of 3-4 files each. I made sure that each bin had at least three of the four possible dither-positions represented to maximize the spatial coverage of each bin. Using Mike's *chi2* program, the results for the map-wide Q-U average χ_r^2 are:

Bins 1, 2, and 3: Stokes $\chi_r^2 = 1.59$

Bins 4, 5, and 6: Stokes $\chi_r^2 = 1.67$

The level of systematic error on three-bin time scales can be estimated as Stokes $\chi_r^2 = 1.63$, which is the average of the above two values.

Bins 1, 2, 3, 4, 5, and 6: Stokes $\chi_r^2 = 1.72$

Since the Stokes χ_r^2 does not go up much (1.63 to 1.72) as we lengthen the time-scale sampled, its probably reasonable to treat the extra errors as random errors occurring on the ~hour time scales that characterize the three-bin groupings. Accordingly I simply inflate the nominal errors by the square root of the Stokes χ_r^2 .

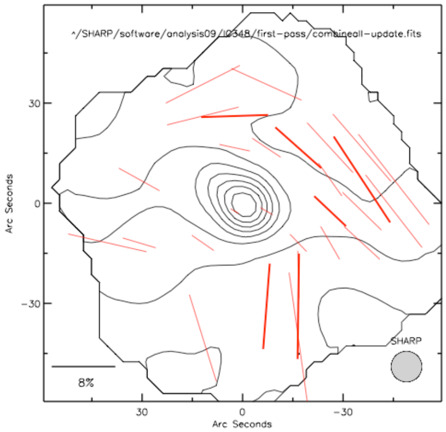
The appearance of the Stokes χ_r^2 map outputted by *chi2* for the six-bin analysis is fairly random. In particular the peaks in χ_r^2 are not clearly correlated with flux levels. I didn't look at the three-bin chi2 maps.

Methods for error-inflation and results:

I use two different methods for inflating the nominal errors. These are the *update* method and the *map-wide inflation factor* method. They are described in my May 14th memo.

Maps are shown on the next page. On the left I show maps made using the *update* method and on the right I show the results of the *map-wide inflation* method. For all maps, thick bars are 3-sigma, thin bars are 2-sigma. The top row is the six-bin case, the next row is the first group of three bins, and the bottom row is the last group of three bins.

Note that (at least for the six-bin maps) the contour at far bottom left is a positive contour representing an increase in flux at the bottom left edge. Contours are 90%, 80%, 70%, … of peak flux. Note that the use of the *update* method is quite inaccurate when there are only 3 bins (as is the case for bottom two rows). Finally, note that the polarization levels can be quite high. (The key is at 8%.)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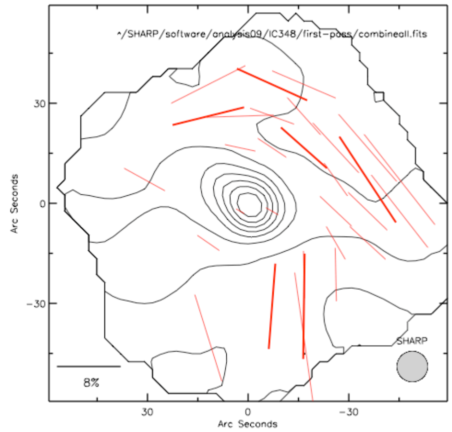
30
0
−30
Arc Seconds
30
0
−30
Arc Seconds
SHARP
8%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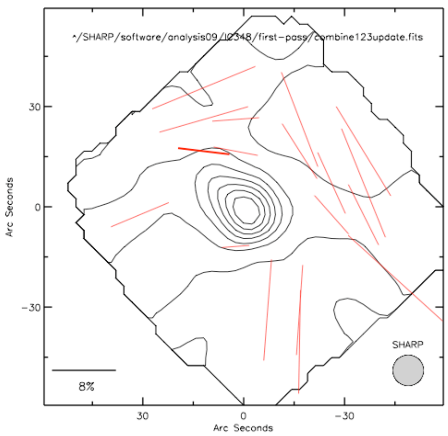
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Arc Seconds
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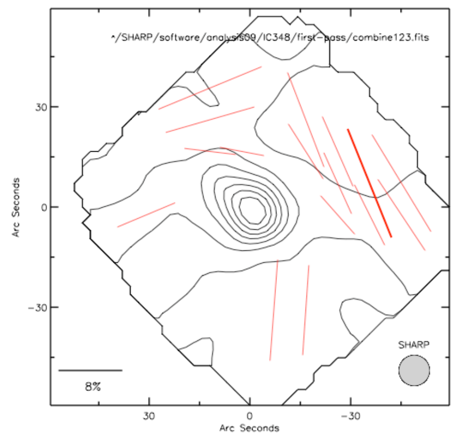
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Arc Seconds
SHARP
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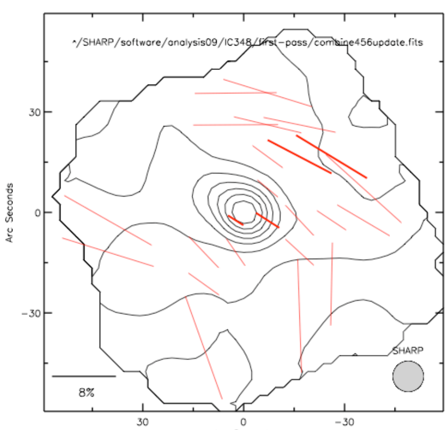
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Arc Seconds
SHARP
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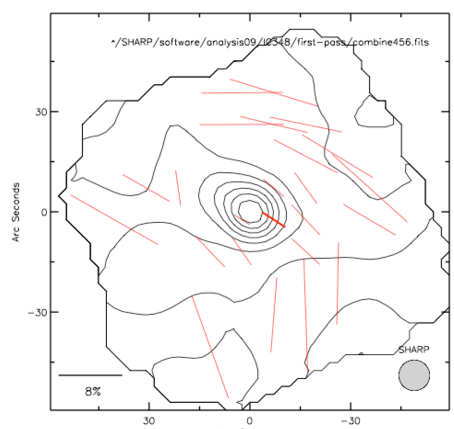
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