Poster No. SH23A-1526 AGU Dec 2009

E. J. Schmahl and G. J. Hurford
(1) Colorado Research Associates / NWRA
(2) SSL/University of California, Berkeley

4. AMPLITUDE FITS FOR THE FLARE OF 2002/04/10

The amplitudes and phases for a 3-minute time interval of the flare were fit by models incliding both the (single-component) primary and its back-scattered emission. The results are shown in Fig. 4 below for the 3 energy bands, 12-15, 15-20, and 20-30 keV.

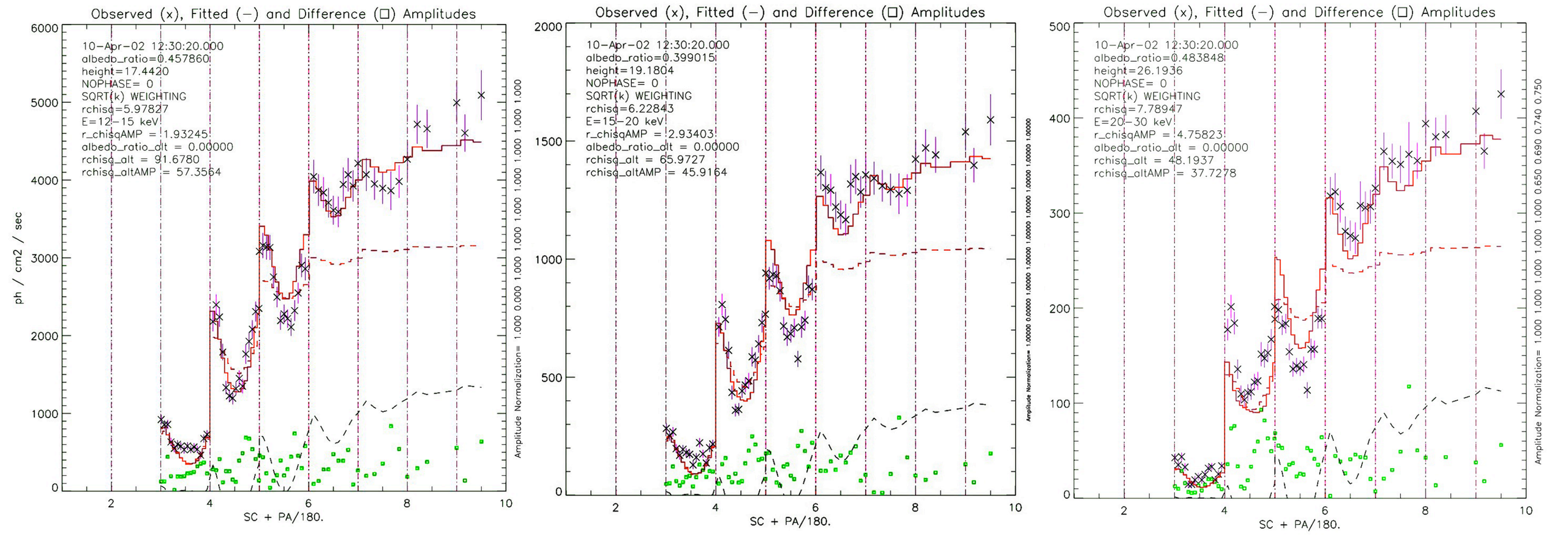

Figure 4. Amplitudes vs subcollimator (SC) and grid position angle (PA) for flare models including back-scattered emission (solid) and without (dashed). The axes in these figures are the same as for Fig. 2.. The black dashed curve is the difference between the models with and without albedo. Much of the errors in fitting are due to inter-detector calibration errors. Although these can be compensated for, they introduce uncertainties in the inferred albedo fraction and the source height.

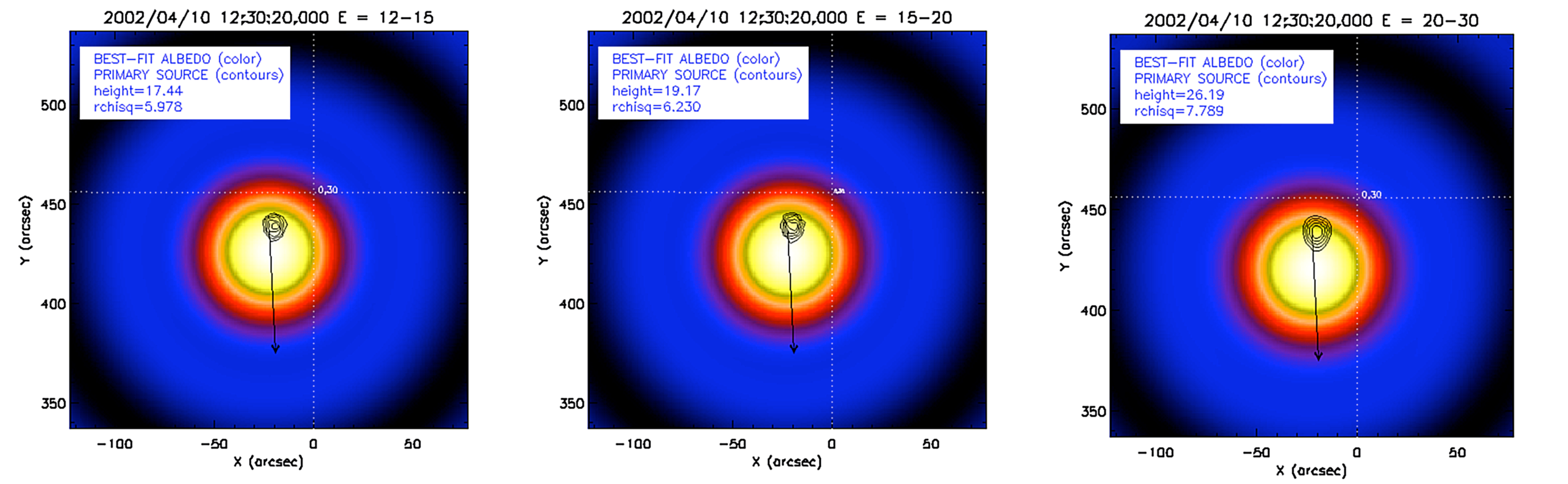

Figure 5. Back-projection maps for three energy bands for the flare of 2002/04/10 (same time interval as Fig. 4.) As in Fig. 3, the arrows point from map center to Sun center. In each case, the model albedo patch was back-projected onto a uniformly sampled Fourier plane.

5. CONCLUSIONS

Using Fourier amplitudes and phases for nine simple (single primary, slowly varying) flares we have found evidence for X-rays back-scattered from the photosphere (the albedo patch). Note that these results are only for the so-called "thermal phase" when a single component dominates the emission.

We have visualized the albedo patch by back-projecting our Forward -Fit model of the best-fit albedo parameters. If the back-scattering process is isotropic (as we assume in the Forward-fit model), the albedo patch is displaced toward sun center from the projected location of the primary source, such that it is vertically below the primary source.

We make several inferences from our results for 9 flares:

1. The model fits of the amplitudes and phases to the observations are significantly better when back-scattered emission is included than if it is not. (Compare the dashed and solid red curves in Fig 4.)
2. The albedo fraction increases with energy in the range 12-30 keV, in qualitative agreement with theory (Bai and Ramaty 1978).
3. We have inferred primary heights ranging from about 10 to 30 Mm, in agreement with the range seen in limb flare observations.
4. In any given flare, the heights of the primary source determined by Forward Fitting do not significantly change with energy, consistent with a thermal interpretation, and also consistent with the single-component nature of our flares.
5. Relative detector-to-detector responses affect these results, and improved calibration would improve our albedo measurements significantly.
6. Extension of these results to some 2-component ("footpoint") flares may be possible, and this would have great significance for spectral work.