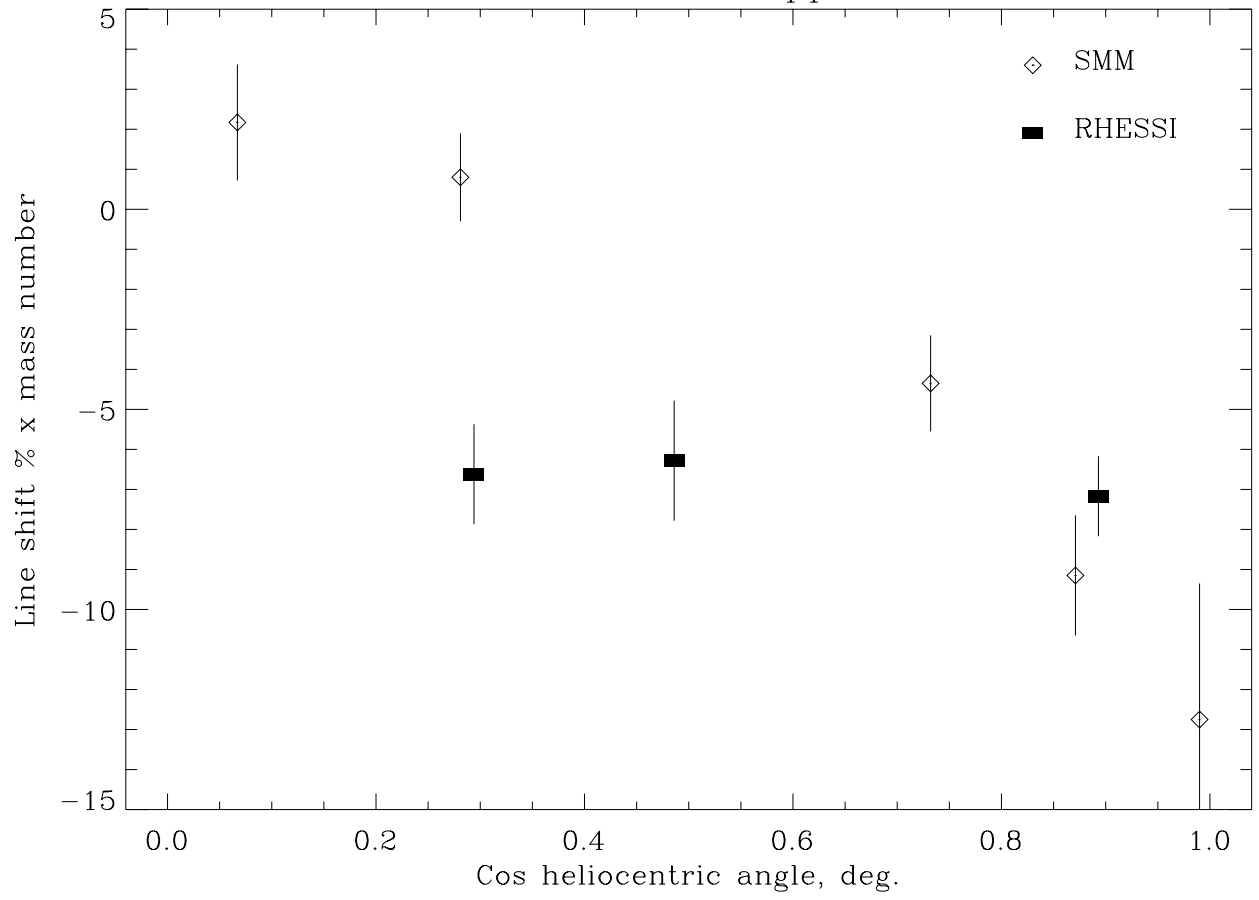


De-excitation line Doppler shifts



Concept

RHESSI measured an anomalously large redshift in the July 23 2003 flare. Explained by a tilt of the footpoint magnetic field lines towards the observer.

This is a preceding-following type of asymmetry, as with the magnetic field polarities in active regions. It should give rise to asymmetrical Doppler shifts between flares on the east and west limbs.

If it is related to the magnetic NS pattern, differential shifts should also be seen between flares on the same limb in different hemispheres and in consecutive solar cycles.

SPI Observations

SPI has detected gamma radiation up to 8 MeV from two flares on opposite limbs of the Sun in the same hemisphere and solar cycle — 4 November 2003 (west) and 7 September 2005 (east).

As seen by the Ge detectors through the BGO rear shielding, they lasted for 7 and 5 min respectively, i.e. not long enough for high flare-associated particle backgrounds to appear. Considerably longer intervals pre-flare were selected for use as backgrounds.

Source and background spectra were

- accumulated event by event, summed into 10 s time bins
- corrected for dead time
- energy calibrated (using known narrow instrumental lines in the background)
- normalized with respect to each other (using the ratio of strengths of instrumental lines in both spectra) — and subtracted.

Flare 07/09/2005 17^h35^m.3 H Angle 89°E

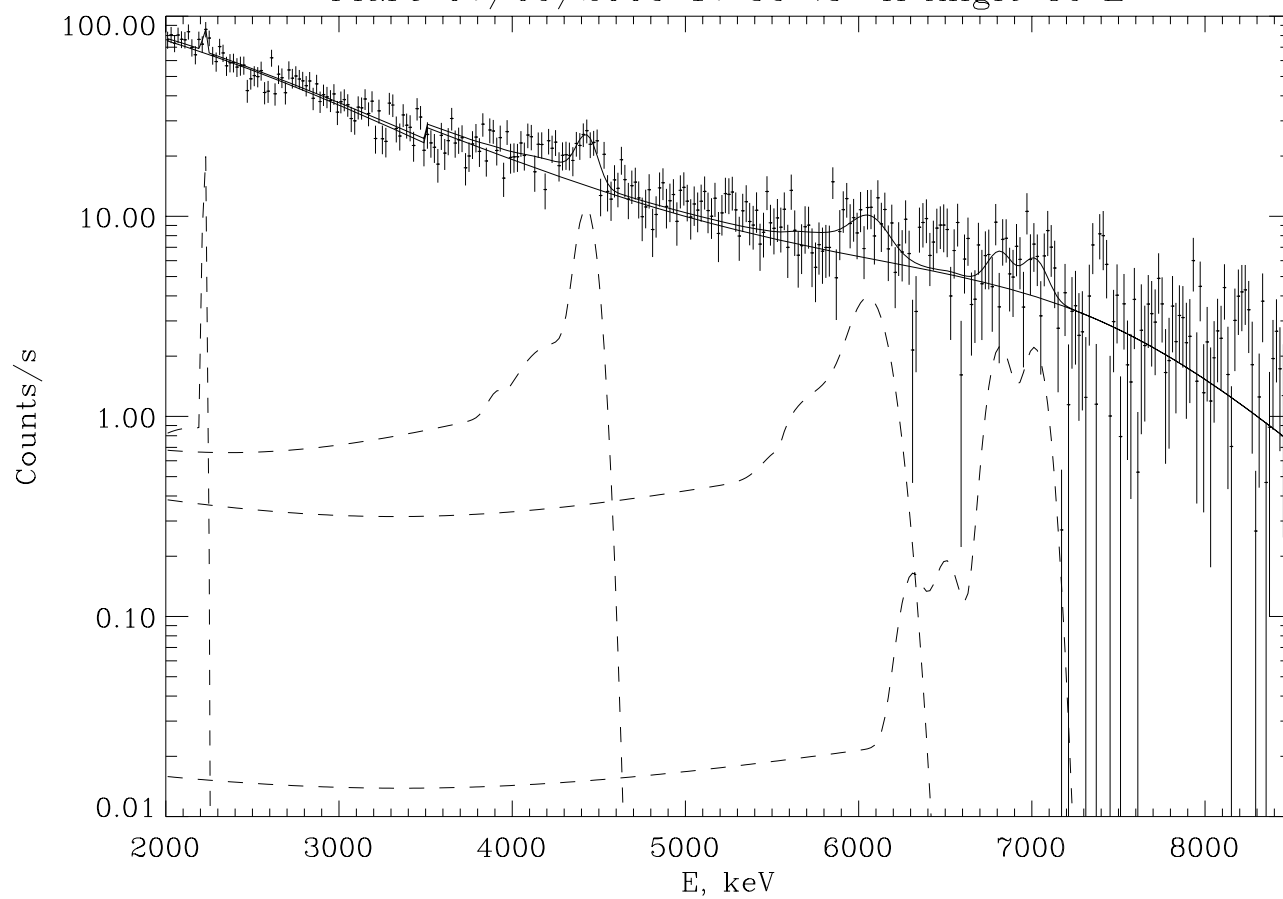


Table 1: Results — all values in keV

Line rest	Energy		Width FWHM	
	Nov 4 2003 (W)	Sep 7 2005 (E)	Nov 4 2003 (W)	Sep 7 2005 (E)
2223	2224.2±0.3	2223.5±0.8	4.0±1.9	3.7±1.8
4438	4423 ⁻¹³ ₊₁₅	4432 ⁻¹¹ ₊₁₃	161±29	132±38
6128	6101±20	6076±34	161±48	239±32
6916	6894±22	6817±31	124±65	155±50

Spectrum fits

The continuum model consisted of an E-dependent power law plus a constant above 3.5 MeV truncated at 7.5 MeV by a Woods-Saxon function to represent the nuclear "continuum".

The line model includes for each line the escape peaks and Compton scattering in the instrument. The lines at 6.916 and 7.115 MeV were fixed in a 1:1 amplitude ratio and a 1.99 MeV energy separation.

There is also a contribution from Compton scattering in the Sun for the 2.2 MeV line.

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