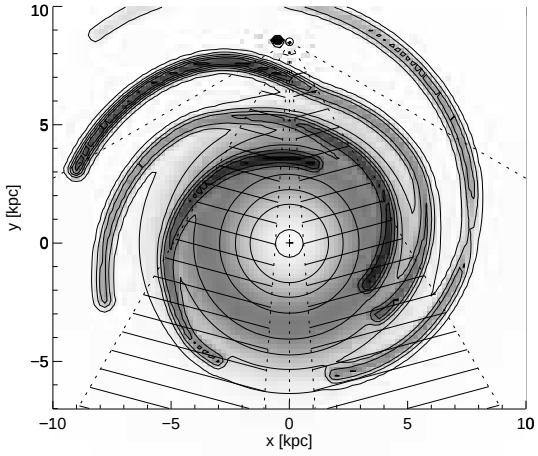
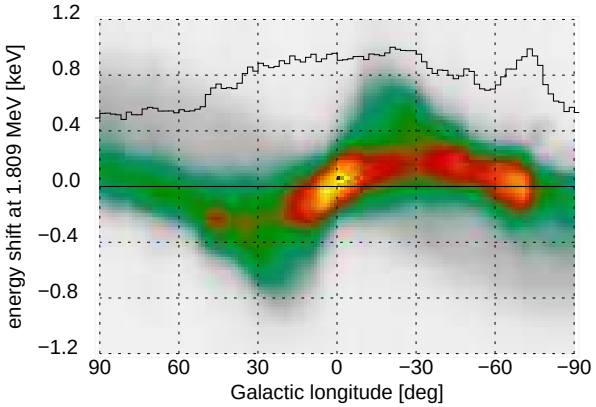
Gamma rays from ^{26}Al in the Galaxy

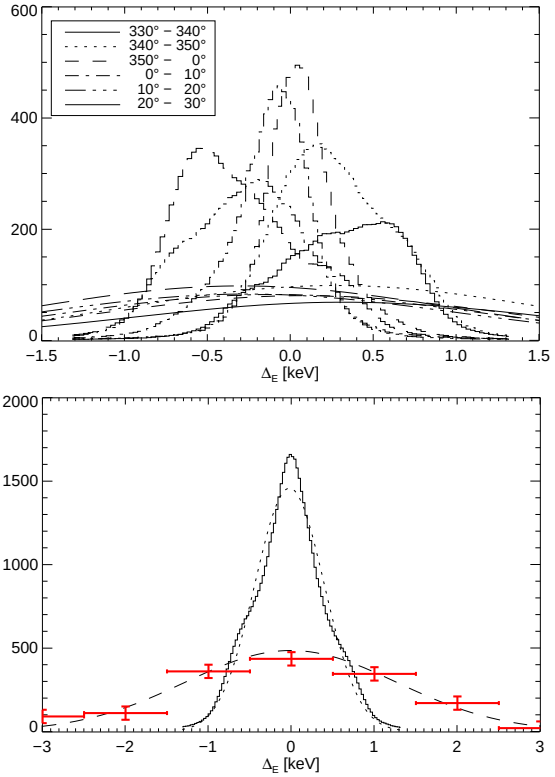
The detailed appearance of the 1.8 MeV gamma-ray line from the radioactive isotope ^{26}Al is determined by its kinematics when it decays after its ejection into the interstellar medium. We model the line shape as expected from Galactic rotation and expanding supernova ejecta, and predict a value below 1 keV (FWHM) with plausible assumptions about ^{26}Al initial velocities and expansion history. Our results suggest that standard ^{26}Al ejection models produce a line on the narrow side of what is observed by RHESSI and SPI on INTEGRAL. Improved SPI and RHESSI spatially-resolved line width measurements should help to disentangle the effects of Galactic rotation and of ISM trajectories of ^{26}Al on the line shape.



Our model is composed of a Monte Carlo sample of individual ^{26}Al sources taken from a source density function we assume to be proportional to the density of free electrons. The figure shows a section through this function taken in the plane of the Galaxy. The shaded areas denote the east and west parts of the inner radian, where the largest Doppler shifts occur.



The colour-coded map shows the modelled ^{26}Al intensity as a function of galactic longitude



(horizontal axis, in 2° wide bins) and Doppler energy shift (vertical axis). The superimposed solid line shows the longitude profile of the energy-integrated intensity for comparison.

Model spectra for the inner Galaxy compared to first year data from SPI in adjacent 10° wide galactic longitude intervals (top, $l \in [-30^\circ, 30^\circ]$). The variation of the mean energy for the six regions shown is about ± 0.3 keV. Integrating a measurement over this longitude range, we ideally expect a $\approx 1\,\mathrm{keV}$ wide line (histogram in bottom figure). SPI's instrumental resolution broadens this (dashed line).

References: K. Kretschmer, R. Diehl & D. H. Hartmann 2003, A&A, 412, L47-L51 (`astro-ph/0311218`)
R. Diehl et al. 2004, ESA SP-552, in press

K. Kretschmer, R. Diehl, D. H. Hartmann