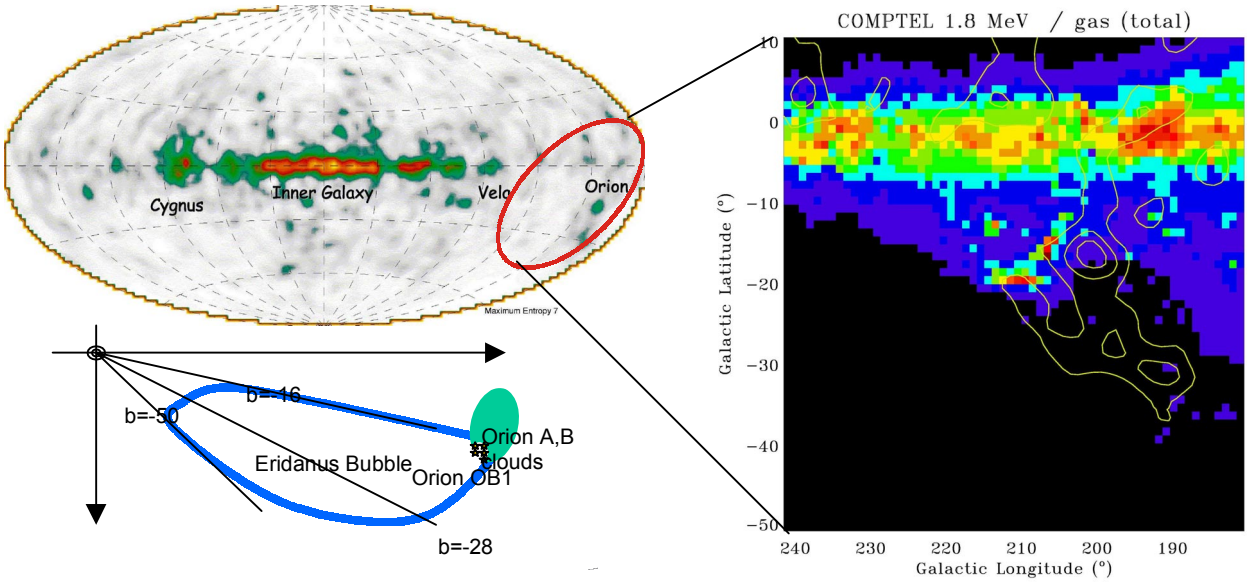
^{26}Al Nucleosynthesis in the Orion Region



The COMPTEL 9-year sky survey map of ^{26}Al gamma-rays at 1809 keV energy (top left) shows significant emission near the Orion molecular clouds. The ^{26}Al appears located southward of the massive Orion gas clouds (the figure top right shows in colour the total gas in the region (from HI and CO observations), with the ^{26}Al emission superimposed as yellow contours). This suggests that ^{26}Al produced in recent nucleosynthesis by the massive stars of the Orion OB1 association has been vented into the Eridanus cavity blown by previous massive star activity in older subgroups of Orion OB1 (see sketch of a side view of this part of the Galaxy on bottom left)

The imaging telescope COMPTEL viewed the sky during the 9-year Compton Gamma-Ray Observatory mission through >340 2-week exposures. Deconvolution through various iterative methods converged at images which show the plane of the Galaxy and a few localized regions, among them the anticenter region south from the Orion molecular clouds, as prominent sources of ^{26}Al radioactivity. With a radioactive decay time of 1.04 10^6 y, it was inferred that the observed 1809 keV gamma-ray line reflects massive-star nucleosynthesis throughout the Galaxy.

Our study of the Cygnus region has shown that population synthesis estimates of the integrated ^{26}Al yield from these clusters as compared to other products of these massive stars (ionization, cavities) present a plausible overall model. ^{26}Al ejection into the surrounding interstellar medium provides a diagnostic of massive-star/ISM interactions on the My time scale.

In the Orion region, the proximity (~450 pc) of the 26Al sources present a special opportunity: It is believed that the Orion OB1 association is the most active driver of the gas morphology over the past tens of Myrs through its supernovae and massive-star winds, and is responsible for separating the Orion A and B clouds as well as generating the Eridanus superbubble. If we adopt this interpretation, it is plausible that ^{26}Al from nucleosynthesis in massive stars over the past Myrs, i.e., from most recently formed massive stars, will find an ISM structure which guides the ejecta from these more recent Wolf Rayet stars and supernovae. The ^{26}Al transport away from the OB1 association will preferentially stream towards the Eridanus cavity, and the gamma-ray line observations will record this transport with ^{26}Al decay (t~1My) superimposed. INTEGRAL's spectrometer with ~2 keV energy resolution (launch Oct 2002) will add crucial line shape information.

References:

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