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Massive-Star Nucleosynthesis and INTEGRAL

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Products from massive-star nucleosynthesis have been measured with SPI on INTEGRAL: Characteristic gamma-ray lines from radioactive decays of long-lived 26Al and 60Fe isotopes, and from 44Ti decay (decay time 89y). Detections of both these isotopes has laid the foundation to peek into massive-star interiors, through different views at those measurements. The gamma-ray flux can be converted into amounts of these radioactive isotopes, but the constraints which derive from this for massive star models involve additional steps. -- Earlier results had demonstrated the basic constraints inherent to such radioactivity data, i.e. detection of 26Al is a calibration for massive-star yields, 60Fe enables an isotopic-yield ratio test eliminating modeling and observing bias aspects, and 44Ti searches showed that its production does not occur homogeneously over core-collapse events. The current status of 26Al and 60Fe observations and their analysis is reaching a threshold for astrophysical insights: Specific regions of massive star groups and their radioactivity gamma-rays have recently been investigated, such as Sco-Cen and Orion. As for 44Ti, spectroscopical information constrains ejection velocities of these inner supernova ejecta for the Cas A event. These parameters for massive stars can be related to other fields of astronomy, of nuclear physics experiments and theory, and of theoretical astrophysics. Thus, model improvements appear on the horizon, as e.g. implemented in the EuroGenesis program framework of the European Science Foundation.

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