

# Thallium-208 as a Real-Time Signal for Probing Heavy Element Synthesis

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Understanding the formation of the heaviest elements has long been a pivotal inquiry and recent progress spurred by LIGO's detection of gravitational waves now lead us to examine kilonovae as crucial markers in unraveling the processes behind the synthesis of those elements. Notably, the emission spectra of MeV gamma rays could lead to strong insight in the identification of individual isotopes if specific lines can be associated to specific isotopes. For example, the 2.6 MeV gamma-ray emission line from thallium-208 has been well known in various branches of science, but it has never been pointed out as a potential real-time indicator of heavy element production in an astrophysical context. In this talk, I will show that Tl-208 could be detectable ~12 hours to ~10 days, and again ~1-20 years following a Galactic neutron star merger, implying that the r process in such events is capable of synthesizing elements such as lead and gold. In addition, I will discuss the implications of Tl-208 as a potential indicator of the synthesis of heavy elements via the i process in some types of AGB stars and rapidly accreting white dwarfs. This is a strong argument for the importance of future MeV telescope missions aiming to detect Galactic events, but that may also be able to reach nearby galaxies in the Local Group.

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