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MeV Gamma Rays from Fission: A Distinct Signature of Actinide Production in Neutron Star Mergers[1] XILU WANG, NICOLE VASSH, University of Notre Dame, TREVOR SPROUSE, MATTHEW MUMPOWER, Los Alamos National Laboratory, RAMONA VOGT, Lawrence Livermore National Laboratory, JORGEN RANDRUP, Lawrence Berkeley National Laboratory, REBECCA SURMAN, University of Notre Dame — Neutron star mergers (NSMs) are the first verified site of rapid neutron capture (r-process) nucleosynthesis, and could emit gamma rays from the radioactive isotopes synthesized in the neutron-rich ejecta. These MeV gamma rays may provide a unique and direct probe of the NSM environment as well insight into the nature of the r process, just as observed gammas from the ^{56}Ni radioactive decay chain provide a window into supernova nucleosynthesis. In this work, we include the photons from fission processes for the first time in estimates of the MeV gamma-ray signal expected from a NSM event. We consider NSM ejecta compositions with a range of neutron richness and find a dramatic difference in the predicted signal depending on whether or not fissioning nuclei are produced. The difference is most striking at photon energies above ~ 3.5 MeV and at a relatively late time, several days after the merger event, when the ejecta is optically thin. We estimate that a Galactic NSM could be detectable by a next generation gamma-ray detector such as AMEGO in the MeV range, up to $\sim 10^4$ days after the merger, if fissioning nuclei are robustly produced in the event.

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