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Photons signaling a phase transition in nuclear matter during neutron star mergers

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Binary neutron star mergers are thought to be the engines of some short gamma ray bursts. We show that a merger creates conditions of sufficiently high density and temperature that a phase transition from nuclear to quark degrees of freedom may occur. For a signal of the transition, we study photons produced by the decay of collective modes of the quark plasma. These photons have a characteristic quasi-thermal spectrum and a high energy associated with their origin in quantum chromodynamical effects. Placed in the context of the hot plasma and competing sources of electromagnetic radiation in the merger, these photons may provide a signature of the phase transition and thus also support the binary neutron star-short gamma ray burst connection.

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