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Direct photons in high energy proton-proton and nucleus-nucleus collisions

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Direct photons serve as unique probes in high-energy proton-proton and nucleus-nucleus collisions, interacting weakly with the dense and hot quark-gluon medium formed during these events. These photons escape freely, providing undistorted information about the collision's evolution. The Quark-Gluon Plasma (QGP), comprising deconfined quarks and gluons, is believed to have existed in the Universe shortly after the Big Bang. As the QGP cools, it transitions into the hadronic matter that we observe today. In laboratory settings, small-scale "Big Bangs" are artificially created through high-energy heavy-ion collisions, which heat the hadronic matter to temperatures of approximately 150 MeV, leading to the formation of the QGP. By studying prompt, pre-equilibrium, and thermal photons emitted during these collisions, we can estimate the effects of cold and hot nuclear matter and gain insights into the temperature, correlations, and collective phenomena within the QGP.

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