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Upper Field-strength Limit of Fast Radio Bursts

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Fast radio bursts (FRBs) are cosmological radio transients with an unclear generation mechanism. Known characteristics such as their luminosity, duration, spectrum, and repetition rate, etc., suggest that FRBs are powerful coherent radio signals at GHz frequencies, but the status of FRBs near the source remains unknown. As an extreme astronomical event, FRBs should be accompanied by energy-comparable or even more powerful X/γ-ray counterparts. Here, QED particle-in-cell simulations of ultrastrong GHz radio pulse interaction with GeV photons show that at 3e12V/cm field strengths, quantum cascade can generate dense pair plasmas, which greatly dampen the radio pulse. Thus, in the presence of GeV photons in the source region, GHz radio pulses stronger than 3e12V/cm cannot escape. This result indicates an upper field-strength limit of FRBs at the source.

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