Abstract Submitted
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Radiation from a particle with constant velocity and time-varying charge, with applications to ultrashort pulsed laser filament microwave emission[1] E. L. RUDEN, J. A. ELLE , A. C. ENGLESBE, A. P. LUCERO, A. SCHMITT-SODY, J. E. WYMER, Air Force Research Laboratory, Directed Energy Directorate — A charged particle with constant velocity and time-varying charge $Q(t)$ resulting from charge-exchange with an otherwise stationary medium emits electromagnetic radiation despite lack of acceleration of the particle itself. This occurs regardless of whether the particle is real, such as a heavy ion traversing an electron stripper, or the electromagnetic equivalent, such as when charge equals the time integral of a short current pulse caused by an ultrashort pulse laser (USPL) wave packet after it has self-focused via the Kerr effect. The pulse width of the radiation is the time interval over which $Q(t)$ varies times $(1 - \beta \cos\theta)$, assuming the particle dimensions are negligible relative to βc times this pulse width. Here, β is the particle speed relative to the speed of light in the medium c, and θ is the emission angle relative to the direction of motion. The violation of this assumption for small θ for $\beta \approx 1$, such as occurs for USPL filamentation in a gas, provides the basis for estimating the time scale of the current pulse, a parameter of great interest for understanding its physical mechanism.

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