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**Describing electron motion in ultra-high intensity laser plasma interactions: the inclusion of a stochastic radiation reaction force** CHRISTOPHER RIDGERS, University of York — At intensities soon to be reached by next-generation laser facilities (exceeding 5x$10^{22}$W/cm$^{-2}$) electrons are accelerated so violently in the laser fields that they radiate energy (as gamma-ray photons) comparable to that they gain from the laser pulse. In this case the radiation reaction force becomes important in determining their motion. However, at these intensities the electric field in the electron's rest frame approaches the Schwinger field; the critical field of quantum electrodynamics where quantum effects on the radiation reaction force become crucial. In particular, the force transitions from a deterministic classical force to a stochastic force. I will compare electron motion when the radiation reaction is treated classically and stochastically, showing that the two treatments give the same result in the classical limit (correspondence) and that, surprisingly, a modified deterministic force (called the "semi-classical" model) can also be used when quantum effects are strong. I will also demonstrate that the semi-classical treatment fails to predict the rate of pair production by the emitted gamma-ray photons. To describe pair production one needs to adopt a new model for electron motion where the motion is described in terms of the evolution of a probability function in phase space as opposed to motion along a classical (deterministic) worldline.

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