

Cockcroft Institute Seminar

**Collective Interaction Control of Optical Frequency e-Beam
Current-Noise and Coherence enhancement
of FEL Radiation Below the Shot-Noise Limit**

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Abstract

A theoretical model for longitudinal collective Coulomb interaction in a charged particle beam is presented. It suggests a possibility to control optical frequency shot-noise current in accelerated electron beams.

For short interaction lengths, the model describes well “Micro-bunching instability” and the unexpected enhance Coherent Optical Transition Radiation (OTR) emission effects, which were observed in the electron beam accelerator injector of LCLS and in other accelerator laboratories.

For a longer interaction length (quarter plasma oscillation period) our model predicts the possibility to reduce the beam current-noise below the classical shot-noise level. Such an effect has not yet been observed experimentally at optical frequencies. If realized, and extended to the X-UV wavelengths regime, it would have an impact on efforts to attain highly coherent FEL radiation sources in this regime.