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Algorithm for calculating coherent radiation from many particles

ALEC THOMAS, University of Michigan — An efficient algorithm for calculating coherent radiation in the far-field is described. Direct integration of the Lienard-Wiechert potentials for extremely high photon energies and many particles is made computationally feasible by a mixed analytic and numerical method. Exact integrals of spectral intensity are made between discretely sampled trajectories by assuming the space-time four-vector is a quadratic function of proper time. The integral of the trajectory with respect to time, the modulus squared of which comprises the spectral intensity, can then be formed by piecewise summation of exact integrals between discrete points. Because of this, the calculation is not restricted by discrete sampling bandwidth theory, and time- steps much larger than the inverse of the maximum frequency can be taken. The technique is incorporated into a radiation code *Radampeltrac*. Calculations of non-linear Thomson back-scattering of a 150 MeV electron bunch from the HERCULES laser system show angularly resolved spectral intensity photon distributions extending to 10 MeV in a well collimated beam. An experimentally measurable difference in the photon spectral distribution with and without radiation damping is demonstrated.

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