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Theory and simulations for high K/γ regimes in undulator and ion channel devices

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A fundamental comparison between undulator and ion channel radiation is presented. Conventional theory for both devices fails at describing high K and K/γ regimes, providing an underestimation of particle trajectory amplitude and period. This may lead to a wrong estimation of radiation emission in many setups of practical interest, as the ion column. A redefinition of plasma density and undulator strength expressions leads to a more reliable prediction of particle behavior, reproducing the closest possible conditions in the two devices. Then, differences in spectral features may be addressed via analytical and numerical simulations of single particle and full beam dynamics. In this contribution we outline a theoretical framework and show the unique spectral features and drawbacks related to such an extreme undulation regime.

Presenter: FRAZZITTA, Andrea (Istituto Nazionale di Fisica Nucleare)