Friday 14 July 2023, at 15:00

Speaker is

Dr. Luca Serafini

and the subject is

Large recoil, symmetric photonic colliders, a way towards ultra-low emittance positron beams and intrinsically mono-chromatic gamma-ray beams

We illustrate the generation of secondary particle beams in electron/photon collisions with various set-ups, going from synchrotron radiation (electron - virtual photon collision, i.e. negligible recoil) towards Inverse Compton Scattering at very large recoil, showing that the statistical properties of secondary beams (bandwidth, emittance) greatly benefit from peculiar effects of large recoil collisions, mainly connected to the slowing down of the center of mass reference system movement in the laboratory, that in turns is associated to lowering the Lorentz boost applied to the secondary beam. Exploiting such a property, we can study the generation of ultra-low emittance positron beams and/or very

small bandwidth X/g ray beams (the case of muon beams was discussed in a previous seminar of this series). Furthermore, we recently found a particular mode of electron-photon collisions that we named Symmetric Compton Scattering: it is chara-

cterised by a steady center of mass system and it represents exactly the divide between Inverse Compton Scattering and Direct Compton effect (that one discovered by A. Compton in 1923 and explained by him invoking the quantum nature of light, i.e. the existence of photons). SCS is the only electron-photon collision characterised by a vanishing correlation between the energy of the scattered photons and their scattering angle: such a property, when SCS occurs at large recoils, transfers mono-chromaticity from the incident electron beam to the scattered photon beam, opening the way to the generation of mono-chromatic gamma-ray beams using moderate energy electron beams colliding with large bandwidth X-ray beams (like those generated via bremsstrahlung), representing a compact, laser-less, more sustainable alternative to present ICS sources for nuclear photonics and photo-nuclear physics. SCS may have further interesting applications in cosmology (see Synchro-Compton catastrophe) and in plasma physics (plasma heating with SCS scattered electrons).

See https://arxiv.org/abs/2304.08788

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