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extreme high brightness electron beam generation in a space charge regime

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The generation of ultra-short, low emittance and low energy spread electron bunches is nowadays a critical requirement for accelerators in plasma wave or for femtosecond light sources. These are applications where the scientific community is strongly investing in terms of study, and money, with projects and test facility around the world. This paper describes a new longitudinal compression scheme, where a balanced using of Velocity Bunching and Ballistic Bunching current techniques with the space charge permits to enter in a peculiar regime, Hybrid Laminar Velocity Bunching. It is a regime where the bunch is longitudinal compressed to the disadvantage of the transversal size, and where the over-bunching is forbidden by the laminarity; going to the minimal longitudinal dimension the bunch is adiabatically frozen and transversally refocused. This regime, as well as giving extremely high brightness, heats the uncorrelated energy spread resulting in electron distributions that, in case of bending paths, does not require Laser Heater devices.

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