The Coherent Synchrotron Radiation as a frequency comb

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Frequency combs (FC) have radically changed the landscape of frequency metrology and high-resolution spectroscopy investigations extending tremendously the achievable resolution while increasing signal to noise ratio. Initially developed in the visible and near-IR spectral regions[1], the use of FC has been expanded to mid-IR[2], extreme ultra-violet[3] and X-ray[4]. Significant effort is presently dedicated to the generation of FC at THz frequencies. One solution based on converting a stabilized optical frequency comb using a photoconductive terahertz emitter, remains hampered by the low available THz power[5]. Another approach is based on active mode locked THz quantum-cascade-lasers providing intense FC over a relatively limited spectral extension[6]. Alternatively, we show that dense powerful THz FC is generated over one decade of frequency by coherent synchrotron radiation (CSR). In this mode, the entire ring behaves in a similar fashion to a THz resonator wherein electron bunches emit powerful THz pulses quasi-synchronously. The observed FC has been fully characterized and is demonstrated to be offset free[7]. Based on these recorded specifications and a complete review of existing THz frequency comb, a special attention will be paid onto similarities and differences between them.

References

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