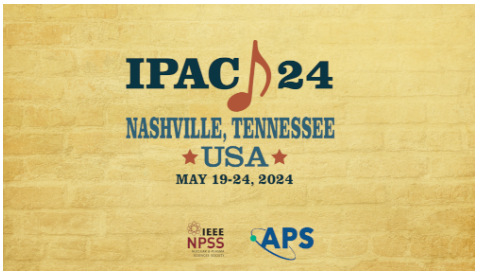

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Undulator radiation of single electrons: coherence length and quantum-optical properties

Monday, 20 May 2024 16:00 (2 hours)

The aims of the CLARA experiment at the Fermilab Integrable Optics Test Accelerator (IOTA) were to directly measure the coherence length of undulator radiation emitted by a single electron and to test whether the radiation is in a pure classical Glauber coherent state or in a quantum mixture of coherent and Fock states. We used a Mach-Zehnder interferometer (MZI) to study visible radiation generated by 150-MeV electrons circulating in the ring. The relative delay between the two arms of the MZI was adjusted by varying the length of one of them with a resolution of 10 nm. The intensity of the circulating beam spanned several orders of magnitude, down to single electrons. A pair of single-photon avalanche diodes (SPADs) was placed at the output of the MZI arms to detect photocounts with high efficiency and timing resolution. We describe the observed interference patterns and photocount rates as a function of interferometer delay and discuss their implications.

Footnotes

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