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The high harmonic radiation with mild energy modulation based on storage ring

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The synchrotron radiation generated by storage rings offers numerous advantages, including high stability, a broad photon energy range, and the capacity to support multiple users simultaneously. However, one notable limitation is its poor radiation coherence. Achieving coherent harmonic generation (CHG) in storage rings would not only significantly enhance the coherence of the emitted light but also dramatically improve specific spectral ranges, internal luminous flux, brightness, and energy resolution. However, the realization of higher order harmonic radiation usually requires higher energy modulation. In this paper, a relatively mild energy modulation scheme is proposed to generate higher harmonic radiation based on storage rings. Lower energy modulation is achieved by using a lower power laser, and then an additional self-modulation section is introduced to enhance the bunching factor of harmonics. Three-dimensional time-dependent simulation results based on the parameters of Hefei light source-II show that the modulation amplitude is reduced by half under the same harmonic radiation power, which can greatly improve the tolerance of the modulation to the momentum aperture in the ring and reduce the damping time to achieve coherent radiation with higher repetition rate.

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