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Study on radiation performance of circular polarization in traditional APPLE-KNOT undulator

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The traditional APPLE-KNOT undulator forms composite magnetic fields by superimposing APPLE fields and KNOT fields with the period ratio of 2:3. The APPLE field serves as the main component to approximate the target photon energy, while the KNOT field acts as an additional component to transversely deflect the electron beam away from axis. Variable polarization states can be generated with a low on-axis heat-load in the APLLE-KNOT undulator. Compared the traditional APPLE-KNOT undulator with the APPLE II undulator, a sharp reduction on flux of circular polarization state can be observed. In this paper, this phenomenon is detailed discussed from the theoretical perspective. It indicates that a larger period length of KNOT field than APPLE field with a strong field contribution of KNOT field will greatly suppress the flux of circular polarization state, which is highly consistent with the simulation result. To keep a good performance both at the linear and circular polarization states with little on-axis heat load, the period ratio and field amplitude ratio between APPLE and KNOT fields should be comprehensively optimized.

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