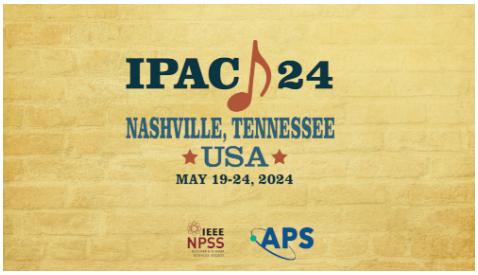

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Instability of asymmetric electron drive beams in hollow plasma channels

Sunday, 19 May 2024 16:00 (2 hours)

Using hollow plasma channels is one approach to compact positron acceleration, potentially reducing the cost and footprint of future linear colliders. However, it is prone to transverse instabilities since beams misaligned from the channel axis tend to get deflected into the channel boundary. In contrast, asymmetric electron drive beams can tolerate misalignment and propagate stably after the initial evolution, but this has only been reported for short distances. In this work, we use quasi-static particle-in-cell simulations to demonstrate the instability of asymmetric drivers even after splitting into two beamlets and reaching equilibrium. As the driver decelerates, its particles gradually return into the channel, making the driver susceptible to deflection by the transverse dipole mode. To understand this behavior, the transverse motion of an individual beam particle is modeled. Strategies to mitigate this instability are also proposed.

Footnotes

Funding Agency

Paper preparation format

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Region represented

Asia

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