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Retrieving transient relativistic plasma dynamics via spin-polarization signals

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Ultrarelativistic plasma is an extreme state associated with strong field QED effects such as radiation reaction, gamma-ray photon emission, and positron generation. This state could exist in ultraviolent astrophysical scenarios or high-intensity laser-plasma interaction. The ultrarelativistic plasma can be polarized due to radiative spin flips within processes of high-energy photon emission. Considering spin is an intrinsic property of charged particles, the new degree of freedom of information carried by the spin polarization could be used to retrieve transient plasma dynamics [1, 2].

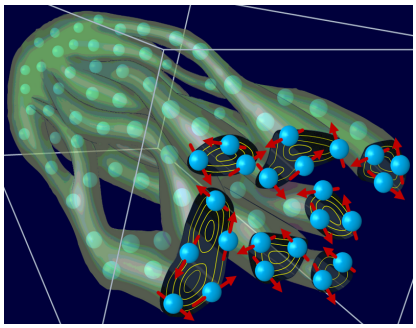

Figure 1. Artist's impression of the electrons during unstable plasma CFI. Blue: electrons with spin rotation axis (red arrows); yellow: magnetic field lines.

This talk will focus on the correlation between transient dynamics and plasma polarization signals. By inspecting electron polarization features, we identified three different regimes of ultrarelativistic plasma current filamentation instabilities [3]. Furthermore, we explored a new mechanism of electron slingshot acceleration in the counterstreaming plasma associated with relativistic collisionless shock precursors [4].

References

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