

# Particle Acceleration and Polarization in the Strong-Field QED Regime

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Laser-driven particle accelerators have attracted significant attention because of their ability to sustain orders of magnitude larger acceleration gradients compared to conventional radio-frequency-based systems. Here we will report our progress on particle acceleration and polarization in the strong-field QED regime. We will show that in the forthcoming 10PW-class laser facilities, polarized electrons can be generated *via* intense laser-irradiated tailored targets induced by radiative spin polarization and angular separation under the standing wave formed by the incident and reflected laser pulses [1]. On the other hand, when the 10PW laser collides with a counterpropagating electron beam, anomalous lepton acceleration could occur with a large focal spot *via* vacuum laser acceleration [2]. We discuss the potential applications in astrophysics and also our recent theoretical work on the generation of polarized electrons [3] and coherent radiation [4].

## References

- [1] X Shen, Z Gong, K Z Hatsagortsyan and C H Keitel, *Phys. Rev. Res.* **6**, L032075 (2024)
- [2] X Shen, Y-Y Chen, K Z Hatsagortsyan and C H Keitel, *Phys. Rev. E* **113**, 035208 (2026)
- [3] D Dai, X Shen and B. Qiao, *Phys. Rev. A* **112**, 033108 (2025)
- [4] D Dai, X Shen and B. Qiao, *Phys. Rev. A* **113**, 063105 (2026)