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Modeling of extreme environments - beam generation, acceleration and interactions within intense fields

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The next generation of lasers will access intensities above 10^{23} W/cm^2. Extreme laser-plasma interactions can be explored to form optical traps, create&accelerate particles and produce novel radiation sources. I will present a QED module coupled with the particle-in-cell framework OSIRIS that allows studying nonlinear plasma dynamics in the transition from the classical to the quantum-dominated regime of interaction. Studies relevant for (near) future experiments will be discussed, as well as the developments relevant for lepton and gamma-gamma colliders approaching this regime.

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