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GEMPIC: Geometric ElectroMagnetic Particle-In-Cell Methods for the Vlasov-Maxwell System and Gyrokinetics MICHAEL KRAUS, KATHARINA KORMANN, ERIC SONNENDRCKER, Max Planck Institute for Plasma Physics, PHILIP MORRISON, The University of Texas at Austin — In this talk we will describe recent work on the development of geometric particle-in-cell methods for the Vlasov-Maxwell system and gyrokinetics. We present a novel framework for particle-in-cell methods based on the discretization of the underlying Hamiltonian structure of the Vlasov-Maxwell system. We derive semi-discrete Poisson brackets which satisfy the Jacobi identity and apply Hamiltonian splitting schemes for time integration. Techniques from Finite Element Exterior Calculus and spline differential forms ensure conservation of the divergence of the magnetic field and Gauss' law as well as stability of the field solver. The resulting methods are gauge-invariant, feature exact charge conservation show excellent long-time energy behaviour. The talk will be concluded with an outline of how to extend these techniques towards gyrokinetics.

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