

# Geometric discretizations of a plasma hybrid model with kinetic ions and mass-less fluid electrons

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## Abstract

We explore the possibilities of applying structure-preserving numerical methods to a plasma hybrid model with kinetic ions and mass-less fluid electrons satisfying the quasi-neutrality relation. Different discretizations derived from Poisson brackets are given and compared with regards to conservation laws and efficiency. The schemes are based on discrete differential forms from finite element exterior calculus (FEEC) for field variables, and particle-in-cell (PIC) methods for Vlasov equation. Quasi-interpolation with local property is used for dealing with the current term to make the methods constructed efficient. The implementation has been done in the framework of the Python package STRUPHY, and has been verified by extensive numerical experiments.