1157-65-51 **xiaofeng cai**, **jingmei qiu*** (jingqiu@udel.edu) and **hong xue**. *An Eulerian-Lagrangian discontinuous Galerkin method for transport problems and its application to nonlinear Vlasov dynamics.*

We propose a new Eulerian-Lagrangian (EL) discontinuous Galerkin (DG) method. The method is designed as a generalization of the semi-Lagrangian (SL) DG method, which is formulated based on an adjoint problem and tracing upstream cells by tracking characteristics curves highly accurately. In the SLDG method, depending on the velocity field, upstream cells could be of arbitrary shape. Thus, a more sophisticated approximation to sides of upstream cells is required to get high order approximation. In this paper, for linear advection problems, we propose a more general formulation, named the ELDG method. The scheme is formulated base on a modified adjoint problem for which upstream cells are always quadrilaterals, which avoids the need to use QC quadrilaterals in the SLDG algorithm. The newly proposed ELDG method can be viewed as a new general framework, in which both the classical Eulerian Runge-Kutta DG formulation and the SL DG formulation can fit in. Numerical results on linear transport problems, as well as the nonlinear Vlasov dynamics using the exponential RK time integrators, are presented to demonstrate the effectiveness of the ELDG method. (Received January 08, 2020)