Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

A characteristic mapping method for two-dimensional incompressible Euler flows[1] BADAL YADAV, OLIVIER MERCIER, JEAN-CHRISTOPHE NAVE, Department of Mathematics and Statistics, McGill University, CRM, Montreal, Canada, KAI SCHNEIDER, I2M-CNRS, Centre de Mathématiques et d'Informatique, Aix-Marseille Université, Marseille, France — We propose an efficient semi-Lagrangian method for solving the two-dimensional incompressible Euler equations with high precision on a coarse grid. The new approach evolves the flow map using the gradient-augmented level set method (GALSM). Since the flow map can be decomposed into submaps (each over a finite time interval), the error can be controlled by choosing the remapping times appropriately. This leads to a numerical scheme that has exponential resolution in linear time. The computational efficiency and the high precision of the method are illustrated for a vortex merger and a four mode flow. Comparisons with a Cauchy-Lagrangian method are also presented.

[1]KS thankfully acknowledges financial support from the French Research Federation for Fusion Studies within the framework of the European Fusion Development Agreement (EFDA).

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Date submitted: 31 Jul 2016 Electronic form version 1.4