JEAN-CHRISTOPHE NAVE, McGill University

The Characteristic Mapping Method: from Dissipative to Dispersive Problems

The characteristic mapping method represents a solution by composing short-time maps. In joint work with Holman–Bissegger and Taylor (arXiv:2611.08261), we extended this construction to dissipative equations by pairing each map with a weight that accounts for local compression. The map-weight pairs compose by a semidirect product, and the resulting field can be evaluated directly off grid.

I will describe how this formulation extends to periodic equations of the form $u_t = Au - \lambda\partial_x(u^2/2)$, where A is a dissipative or dispersive Fourier multiplier. The map is advanced by semi-Lagrangian tracing, while an exponential integrator accounts for the phase of each resolved linear mode. Numerical examples will illustrate the influence of dispersion on phase accuracy and the resolution of fine spatial scales.

I will conclude with the role that geometry plays in the analysis of the method and discuss the additional structure available when the underlying equation admits an Euler-Arnold formulation. Time permitting, I will also discuss a connection with the work of Alama-Bronsard and Laurens on the Benjamin-Ono equation.