

Course Information for Math 597/697Y

- **Instructor:** Panos Kevrekidis
- **Class Hours:** TuTh 1:00 p.m. - 2:15 p.m.
- **Office Hours:**
 1. M 2:00 p.m. - 4:00 p.m.
 2. Th 2:15 p.m. - 4:00 p.m. or
 3. by appointment.
- **Contact Info:**
 1. E-mail: kevrekid@math.umass.edu.
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- **Course Info**
- *Text:* No required text. Bits and pieces of what we will do can be found in Sulem's and Sulem's, "Nonlinear Schrödinger Equation", as well as in numerous other texts, and importantly in notes that I will distribute.
- *Grade:*
 1. Regular Homework (50%).
 2. Research Project (Presentation + Writeup, 50%).

Tentative Syllabus

1. General Introduction and Motivation
 - Presentation/Derivation of FPU, KdV and NLS
 - Modulational Stability, Soliton Emergence.
2. Connections to the Continuum Limit of NLS/KdV
3. Numerical methods Needed (Matlab)
 - Fixed point methods
 - Numerical Integrators
 - Linear Stability Analysis
4. Hamiltonian Particle Systems
 - Lagrangian/Hamiltonian Structure, Poisson brackets
 - Calculus of Variations, Euler-Lagrange equations
 - Noether theory, Invariances, Linearization eigenvalues
5. Infinite Hamiltonian Particle Systems
 - Discrete sine-Gordon, ϕ^4
 - Discrete NLS, 1d, 2d and 3d, Focusing and Defocusing
 - Discrete KdV
6. Different Types of Discretizations
7. Multi-component Models
8. Inverse-Scattering/Multi-Soliton Solutions