Physics 216/116 **Fluid Mechanics for Physicists** **Winter 2018**

Topics

1. Overview, Equations, Ideal Fluids

   - OV of phenomenology, especially turbulence
   - Euler Equations
   - Potential flow, induced mass

2. Vorticity and Viscous Flow

   - Kelvin's Theorem, Induction Equation, Freezing-in Law
   - Navier–Stokes Equations, Viscous Flow, Stokesian Dynamics and Drag, Clamshell Theorem

3. Instabilities

   - Interfacial: Rayleigh–Taylor, Kelvin–Helmholtz
   - Generalized Interchanges: Rayleigh–Bénard convection and extensions
   - Rotation Convection; Taylor–Proudman Theorem

4. Boundary Layers

   - Blasius Boundary Layer, Drag
   - Basics of Drag, Laminar Wake
   - Drag Crisis

5. Turbulence I - Microscopics

   - Basic ideas, K41 Model (in depth), 4/5 Law
   - Richardson Phenomenology, Anomalous Exponents

6. Turbulence II - Macroscopics

   - Pipe Flow Turbulence, Prandtl Law of Wall
   - Turbulent Wakes, Wake Structure
   - Spreading and Entrainment — Loitsyansky Problem
   - Introduction to Closure Models

7. Module I (4 lectures) -TBA

8. Module II (4 lectures) -TBA