PHYSICS 617   Spring 2022

GENERAL RELATIVITY
(Prerequisites)

I will assume that you are familiar with

(I) Graduate Classical Mechanics at the level of Physics 507 or
   Rutgers challenge exam program:

- **Basic:** Lagrangian mechanics, invariance under point transformations, generalized coordinates and momenta, curved configuration space, phase space, dynamical systems, orbits in phase space, phase space flows, fixed points, stable and unstable, canonical transformations, Poisson brackets, differential forms, Liouville's theorem, the natural symplectic 2-form and generating functions, Hamilton-Jacobi theory. integrable systems, adiabatic invariants.

- **Continuum mechanics:** Taut string and lattice of point masses. 1-D wave equation. boundary conditions, 3-D wave equation, Laplacian, plane waves, spherical waves, volume and surface forces, stress and strain, elastic moduli (bulk, shear, Young) stress tensor. Strain tensor. longitudinal and transverse waves in solid. Fluids. "material derivative", inviscid fluid, Bernoulli, eq of continuity. Waves.

- **Field theory:** Lagrangian density, Hamilton's principle for fields, cyclic coordinates, Noether's theorem. Lagrangian formulation of electromagnetism.

(II) Graduate E&M at the level of Physics 501 or Rutgers challenge exam program:

- **Basic:** Gauss law, differential and integral form Poisson and Laplace equations, Green's theorem, Dirichlet and Neumann boundary conditions, boundary value problems with cylindrical and spherical symmetry, Laplace equation in cylindrical and spherical coordinates, magnetostatics, vector and scalar potentials, Maxwell's equations, plane electromagnetic waves, linear and circular polarization.