Phy408, Introduction to Relativity, Spring 2018

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course description is at http://dau2.physics.sunysb.edu/~shuryak/relativity18.html

Time MonWed 4:00-5:20PM , place PHYSICS P128

The main objective of the course is to introduce students to special and general relativity, their mathematical tools and physics applications. The course level is intermediate between undegrad and grad. I believe that mastering the tools of the subject can only come from problem solving, and therefore the course has extensive load of the homeworks. Those can be done by hand, but usage of Mathematica is encouraged, because some tasks are tedious to do by hand. Homework grades will make 60% of the final grade, and the rest from the final written exam. The topics to be discussed include

- math tools:
  - coordinate transformations, metric tensor, invariants
  - covariant and contravariant vector and tensors,
  - from Cartesian to general coordinates
  - Metrics, general tenzors, covariant derivatives, curvature
- special relativity
  - history
  - Lorentz transformations
  - Einstein's theory: solution to paradoxes
  - addition of velocities and rapidity
  - 4-vectors of position, velocity and acceleration
  - relativistic dynamics
- general relativity
  - history
  - motion in curved space: geodesics
  - Schwartzschild solution and black holes
  - Motion in gravitational field, Mercury orbit shift
  - Light deflection and graitational lensing
  - Gravitational waves and their detection events
  - Expanding Universe and Big Bang cosmology

The course is based on "A first course in General Relativity" by B.Schutz (second edition, Cambridge U. Press)