APM 351: Differential Equations in Mathematical Physics Announcement of Third Midterm Test

When and where?

Wednesday, March 15, 5-7pm, MS 2173 (1 King's College Circle). Closed books, closed notes. Big formulas will be provided as needed.

What is covered?

Chapters 9-11 of Strauss (as discussed in class), Assignments 13-17, and selected topics from the earlier part of the course. Specifically:

- *Wave equation in higher dimensions.* The light cone. Energy conservation. Domain of dependence, domain of influence, causality. Qualitative differences between one, two, and three dimensions, Huygens' principle. The formulas of D'Alembert, Kirchhoff, and Poisson. Hadamard's method of descent.

- *Radially symmetric eigenvalue problems.* Separation of variables into angular and spherical variables. Frobenius' method for finding power-series solutions (and specifically polynomial soluions) of a singular ODE. Hermite polynomials and the harmonic oscillator. Radial eigenfunctions of the hydrogen atom. Bessel functions. Spherical harmonics.

- *Eigenvalues of the Laplacian on domains in $\mathbb{R}^d$.* The Rayleigh quotient. Min-max and max-min characterization of eigenvalues; the Rayleigh-Ritz comparison principle. Dirichlet and Neumann boundary conditions. Statement of Weyl's law.