Intro to Lecture 23 Nov. 30, 2016

Last time we discussed integral transforms, concentrating on Fourier transforms but noting there were more general possibilities. We will finish up this topic with Green's functions for self-adjoint second order differential operators in one dimension, and then in particular for the Poisson and Helmholtz equations in higher dimensions.

After this, it is not clear what we should continue with. I could spend one lecture on numerical methods, in particular numerical integration (in one dimension) and numerical techniques for solving ordinary differential equations, including ones which are non-linear, which we have ignored up to now. In the first category we could discuss the Newton-Cotes generalizations of the trapezoid and Simpson's rule formulas, and then Gaussian integration which is extremely powerful on analytic (infinitely differentiable) functions. For ODEs, we could discuss the Runge-Kutta and predictor-corrector method.

On the other hand, you might have already had this or think it better left for a numerical methods course, and be more interested in relativity.

I need to get a feel for how much of special relativity you already know. We need to be familiar with 4-vectors, not only for x^μ but also for the energy and momentum, in particular $P^0 = E/c$, for the 4-current with $J^\mu(x^\nu)$ including the charge density $\rho = J^0$. We discussed these abstractly in Lectures 7-8. We also need to discuss the energy-momentum tensor $T^{\mu\nu}$ and angular momentum and Pauli-Lubański vector. This is one lecture. Again, I want to ask if you are already familiar with these ideas, which will be necessary to go further into general relativity.

I have three lectures on general relativity after this, so we are only slightly behind and do have just enough time to do all of these. But if you think I should skip something, such as the numerical methods, just say so.

- Homework 10 is up and due next Monday at 5, as usual.
