Student talks Physics G8070
Spring '07

Here are some possible topics. If some other subject interests you more just let me know. One person per topic, no need to write up your presentation.

If we manage to stick to schedule I'd like to do the talks on the following Fridays:

4/13 –

4/20 –

4/27 –

1. Supersymmetry on the string worldsheet

We've covered supersymmetry in 0+1 and 3+1 dimensions, and towards the end of the course I'm hoping to spend some time in 9+1 and 10+1 dimensions. But there's another dimension of particular interest: the worldsheet of a string is described by a quantum field theory in 1+1 dimensions. You can make the worldsheet theory supersymmetric, in which case you get the various possible superstring theories. This is described in Green, Schwarz, Witten section 4.1 (you should probably stop at the end of section 4.1.2), also in Polchinski section 12.3 (you should probably stop with equation 12.3.31).

2. Supersymmetry at the LHC

One of the main hopes for the LHC is that it might find supersymmetry. Some of the collider phenomenology is described in Martin, see section 8 for decays and section 9.2 for signals at hadron colliders. There's also a book on the subject, *Theory and phenomenology of sparticles: An account of four-dimensional N=1 supersymmetry in high energy physics* by Drees, Godbole and Roy.

3. Renormalization effects in the MSSM

Renormalization effects in the MSSM can be very important. One celebrated effect of radiative corrections: when you run the gauge couplings you find they meet at the GUT scale. See Amaldi, de Boer and Furstenau, *Phys. Lett.* **B260** (1991) 447. It's also plausible that radiative corrections to the Higgs potential are responsible for driving electroweak symmetry breaking. See Alvarez-Gaume, Polchinski and Wise, *Nucl. Phys.* **B221** (1983) 495. This is also described in Martin pp. 56 – 62.

4. Supersymmetry and dark matter

In the MSSM the lightest superparticle is stable which makes it an attractive dark matter candidate. So-called neutralino dark matter is discussed in section 3 of Feng, *Supersymmetry and cosmology*, hep-ph/0405215.

5. Split supersymmetry

In studying the MSSM one has to make some assumptions about the spectrum of sparticle masses. A rather radical suggestion is that the superpartners of the standard model gauge bosons could be relatively light, while the superpartners of the standard model fermions are extremely heavy. This scenario gives up on some of the traditional motivations for supersymmetry, but it does have some phenomenological advantages. See Arkani-Hamed and Dimopoulos, *Supersymmetric unification without low energy supersymmetry and signatures for fine-tuning at the LHC*, hep-th/0405159.