Physics 290. Special Topics: An Introduction to String Theory.
Professor Michael Dine

Fall, 2009. Syllabus

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Office hours: Tues 2:00-4:00 (subject to change) or by appointment.

Course website: go to department website and click on Dine; follow link to Physics 290 or go to http : //scipp.ucsc.edu/$\tilde{}$dine
Homework and solutions and handouts will be posted here.

Course Description:
String theory is a large subject, and our time is limited. We will spend about half the course on perturbative string theory, constructing the bosonic, Type I, Type II, and heterotic strings. We will focus mainly on the spectrum and on tree level interactions, making a few remarks about higher orders in perturbation theory. Then we will spend some time looking beyond perturbation theory, at D-branes, and at features of the theory which can be gleaned from low energy effective actions (especially exploiting supersymmetry). The spirit will be that of the textbook *Supersymmetry and String Theory: Beyond the Standard Model*, but we will also use the text by Becker, Becker and Schwartz, which is more thorough in its treatment of the various topics.
This will be a challenging course – for you and for me. It is important to devote a lot of time to it. You will need to keep up with the reading. The reading has to be done in a very active way, with pen and lots of scrap paper ready. Similarly for review of class notes. The problem sets are challenging.
Books on Reserve:

1. Green, Schwartz, and Witten, *Superstring Theory.*
2. J. Polchinski, *String Theory*
3. B. Zweiback, *String Theory*

I will put other books on reserve from time to time as seems appropriate.

Homework, exams,etc: There will be a problem set about once per 1.5 weeks. Each student will do a brief final presentation.

Very **tentative Schedule; will be updated as quarter progresses**

It is important to do the indicated reading. Chapters refer to my textbook; I will add readings from BBS later.

1. Week 1 (Sept. 28, Sept. 30). Chapter 21, Bosonic String. Spectrum
2. Week 2 (Oct. 5, 7). Chapter 21, Bosonic String. Interactions
3. Week 3 (Oct. 12,14). Chapter 22. The Superstring
4. Week 4 (Oct. 19,21). Chapter 22. The Superstring
5. Week 5 (Oct. 26,28). Chapter 23. Heterotic String. gravitational fields).
6. Week 6 (Nov. 2, Nov. 4). Chapter 24. Effective Actions in 10 Dimensions. Chapter 25: Compactification of String Theory I.
7. Week 7 (Nov. 9,12). Chapter 25: Compactification of String Theory I.
8. Week 8 (Nov. 16,18). Chapter 26: Compactification of String Theory II: Calabi-Yau Compactifications.
9. Week 9 (Nov. 23,25) Chapter 27: Dynamics of String Theory at Weak Coupling.
10. Week 10 (Nov. 30, Dec., 2) Chapter 28: Beyond Weak Coupling: non-perturbative string theory. some of chapter 19. Beyond General Relativity (String Theory?)