

Physics 250: String Theory and M-Theory

Instructor: **Petr Hořava**

Spring 2007, Tue & Thu, 2:10-3:30, 402 Le Conte Hall

String theory is one of the most exciting and challenging areas of modern theoretical physics, whose techniques and concepts have implications in diverse fields ranging from pure mathematics, to particle phenomenology, to cosmology, to condensed matter theory.

This course will provide a one-semester introduction to string and M-theory, from the basics all the way to the most modern developments. This will be possible because the course will follow an excellent one-volume book that is now being published,

- [1] **K. Becker, M. Becker and J.H. Schwarz**, *String Theory and M-Theory: A Modern Introduction* (Cambridge U. Press, November 2006).

Topics covered in the course will follow the chapters of [1]:

1. Introduction;
2. The bosonic string;
3. Conformal field theory and string interactions;
4. Strings with worldsheet supersymmetry;
5. Strings with spacetime supersymmetry;
6. T-duality and D-branes;
7. The heterotic string;
8. M-theory and string duality;
9. String geometry;
10. Flux compactifications;
11. Black holes in string theory;
12. Gauge theory/string theory dualities, AdS/CFT.

The **prerequisites** for the course are: some knowledge of basic quantum field theory (at the level of 230A or at least 229A), some knowledge of basics of general relativity (at the level of 231). Students who are interested in signing for the course but are worried about not satisfying these requirements are encouraged to talk to the instructor about the possibility of waiving the prerequisites. No systematic prior knowledge of string theory is required; on the other hand, students who have already been exposed to basics of string theory (for example, via a one-semester introduction to the basics of string theory) will also benefit from this modern course.

Some **excerpts from editorial reviews** of [1] (see Amazon.com):

“This elegantly written book will be a valuable resource for students looking for an entryway to this vast and exciting topic of string theory. The authors have skillfully made a selection of topics aimed at helping the beginner get up to speed. I am sure it will be widely read.”

Edward Witten

“This is the first comprehensive textbook on string theory to also offer an up-to-date picture of the most important theoretical developments of the last decade, including the AdS/CFT correspondence and flux compactifications. An excellent resource for graduate students as well as researchers in high-energy physics and cosmology.”

Nima Arkani-Hamed

“Masterfully written by pioneers of the subject, comprehensive, up-to-date and replete with illuminating problem sets and their solutions, [it] provides an ideal preparation for research on the current forefront of the fundamental laws of nature.”

Andrew Strominger