

Syllabus

Course name: Introduction to String Theory

Instructor: Satoshi Nawata and Daisuke Yokoyama,
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Hours: Friday, 13:30-16:10

Place: H3206

Office hour: Whenever, but email us beforehand

Prerequisites:

Quantum Mechanics, Electrodynamics, General Relativity,
Basic knowledge of quantum field theory.

About the course:

The basic idea of String Theory is that elementary particles are excitations of a string. Each quantum excitation of the string behaves like an elementary particle, and closed strings have a massless spin-2 particle in their spectrum, which made string theory a promising candidate for a quantum theory of gravity. It has also been remarkably successful as a theoretical framework capable of influencing other fields of physics and mathematics.

This course will introduce to basics of string theory. String theory is very broad and it is still rapidly developing. Therefore, it is impossible to cover all the topics within one semester. However, we will study selected advanced topics too. First we will learn quantization of bosonic strings and superstrings in RNS formalism, two-dimensional conformal field theories, supergravity, string scattering amplitudes, and D-branes. We also introduce the web of dualities, black holes in string theory and AdS/CFT correspondence.

Undergraduate students are also very welcome to audit this course.

Main content:

- bosonic strings
- superstrings
- string duality and branes
- black holes, AdS/CFT, selected advanced topics.

Main references: Polchinski, String Theory I, II

It is not good idea to try to read through Polchinski in one semester. There are more concise and elementary introductions to string theory. I will use combinations of these references.

Lecture notes by Kazuo Hosomichi, available on [his website](#).

David Tong, String theory [[arXiv:0908.0333](https://arxiv.org/abs/0908.0333)]

Supplementary references:

There are too many references on string theory. I just list the famous books on string theory.

- Green, Schwarz and Witten, Superstring Theory I, II
- Becker, Becker, Schwarz, String Theory and M-Theory: A Modern Introduction
- Zwiebach, A First Course in String Theory

For more information, you can refer to [this website](#).

Grading: Grade will be determined based on homework given every week.