

## Syllabus: String theory I

recommended lecture notes: Dr David Tong: String Theory  
(<http://www.damtp.cam.ac.uk/user/tong/string.html>)

1. Free relativistic strings:
  - (a) relativistic point particle, actions, symmetries
  - (b) Nambu-Goto action, symmetries, Polyakov action, symmetries, gauge fixing and constraints, mode expansion
2. Quantization of the free string
  - (a) covariant quantization
  - (b) lightcone quantization, string spectrum, Lorentz invariance
3. Open strings and branes
  - (a) classical solutions
  - (b) quantization
4. Conformal field theory
  - (a) symmetries, energy momentum tensor
  - (b) quantization, operator product expansion, Ward identities, free scalar field
  - (c) Casimir energy, Weyl anomaly, Virasoro algebra, state-operator map
5. Path integral formulation of string theory
  - (a) Faddeev-Popov method, ghost system, states and vertex operators
6. Interacting string
  - (a) topological expansion, the Virasoro-Shapiro amplitude

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