The lectures will spell out the conformal field theory approach to consistent compactifications of string theory. Both heterotic and open string solutions as well as some insights into M-theory compactified on special holonomy spaces will be discussed. The emphasis will be on analyzing the the proto-type orbifold and orientifold models and the resulting spectrum and couplings in the effective four-dimensional theory.

Lecture I:

Review of consistency conditions, quantization of the physical spectrum and string amplitude calculations for the effective theory from heterotic and type II superstring are reviewed. The approach assumes basics knowledge of field-theory and some introductory knowledge of string theory. Basic techniques of conformal field theory will be introduced, and these techniques employed to determine the physical spectrum an amplitude calculations.

L. J. Dixon, "Introduction To Conformal Field Theory And String Theory," *Lectures presented at Theor. Adv. Study Inst. in Elementary Particle Physics, Boulder, CO, Jun 4-30, 1989.*

M. E. Peskin, "Introduction To String And Superstring Theory. 2," *Lectures presented at the 1986 Theoretical Advanced Study Institute in Particle Physics, Santa Cruz, Calif., Jun 23 - Jul 19, 1986.*

M. Green, J. Schwarz and E. Witten, " String theory I" (selected chapters)

J. Polchinski, "String Theory I" (selected chapters)

E. D'Hoker, "TASI lectures on critical string theory," UCLA-92-TEP-30 *Lectures given at Theoretical Advanced Study Institute (TASI 92): From Black Holes and Strings to Particles, Boulder, CO, 3-28 Jun 1992*

Lecture II:

Compactification of heterotic string theory to four-dimensions will be addressed from the point of view of conformal field theory: consistency conditions (modular invariance), supersymmetry constraints and the physical spectrum are derived. The concrete example will be based on an orbifold construction. Generalizations to other orbifold based constructions and related generalizations will be discussed and the phenomenological implications of classes of such models with semi-realistic features discussed.

L. J. Dixon, "Some World Sheet Properties Of Superstring Compactifications, On Orbifolds And Otherwise," PUPT-1074 *Lectures given at the 1987 ICTP Summer Workshop in High Energy Physics and Cosmology, Trieste, Italy, Jun 29 - Aug 7, 1987.*

M. Cvetic, "Effective Lagrangian Of The (Blown-up) Orbifolds," *Lectures presented at the Workshop on High Energy Physics and Cosmology, Trieste, Italy, Jun 29 - Aug 7, 1987.*

L. J. Dixon, J. A. Harvey, C. Vafa and E. Witten, "Strings On Orbifolds," Nucl. Phys. B **261**, 678 (1985); "Strings On Orbifolds. 2," Nucl. Phys. B **274**, 285 (1986).

L. J. Dixon, D. Friedan, E. J. Martinec and S. H. Shenker, "The Conformal Field Theory Of Orbifolds," Nucl. Phys. B **282**, 13 (1987).

G. Cleaver, M. Cvetic, J. R. Espinosa, L. L. Everett, P. Langacker and J. Wang, "Physics implications of flat directions in free fermionic superstring models. I: Mass spectrum and couplings," Phys. Rev. D **59**, 055005 (1999) [arXiv:hep-ph/9807479].

Lecture III:

Compactification of open superstring theory on orientifolds (orbifolds with world-sheet parity needed for the inclusion of the open string spectrum) is spelled out. The consistency conditions, the spectrum and couplings are explicitly evaluated for the specific orientifold. Generalizations to orientifold constructions with Wilson lines and branes that intersect at angles are spelled out and recent constructions with three-families standard-like model are described. A connection of these constructions to M-theory compactification on seven-dimensional spaces with special (G_2) holonomy is discussed.

J.Polchinski, "TASI lectures on D-branes," arXiv:hep-th/9611050.

J. Polchinski, "String Theory II" (selected chapters)

E. G. Gimon and J. Polchinski, "Consistency Conditions for Orientifolds and D-Manifolds," Phys. Rev. D **54**, 1667 (1996) [arXiv:hep-th/9601038].

M. Cvetic, G. Shiu and A. M. Uranga, "Chiral type II orientifold constructions as M theory on G(2) holonomy spaces," arXiv:hep-th/0111179;"Chiral four-dimensional N = 1 supersymmetric type IIA orientifolds from intersecting D6-branes," Nucl. Phys. B **615**, 3 (2001) [arXiv:hep-th/0107166].

B. Acharya and E. Witten,"Chiral fermions from manifolds of G(2) holonomy," arXiv:hep-th/0109152.