

String Theory Distinguished Visiting Lectureship

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Gauge Theory and Geometry: Lessons from Duality

In these lectures I will try to convey how physicists are uncovering some remarkable theoretical connections between gauge field theories and gravitation (as encoded in the geometry of spacetime). The first lecture, which will be at a very general level, will introduce the idea that strings naturally arise as excitations of gauge field theories. These strings then give rise to a geometric or gravitational description of the gauge theories. The next two lectures will go deeper into this phenomenon focusing on a particular example where it is possible to understand this connection between gauge theory and geometry fairly explicitly. This example relates a simple gauge theory, the Chern-Simons theory, with a topological string theory. We will see how there are some remarkable mathematical consequences of this connection. Physically, we will also see how this duality helps us understand the open-closed string duality that underlies the general gauge theory/geometry correspondence.

Date and Time

Lecture I	1:00 PM – 2:00 PM	Monday	5/3/2004	Chamberlin 5280
Lecture II	1:00 PM – 2:00 PM	Wednesday	5/5/2004	Chamberlin 4274
Lecture III	1:00 PM – 2:00 PM	Friday	5/7/2004	Chamberlin 5280

Suggested reading:

1. “On the Gauge Theory/Geometry Correspondence”, Rajesh Gopakumar and Cumrun Vafa, *Adv. Theor. Math. Phys.* **3** (1999) 1415-1443, [hep-th/9811131](#).
2. “Enumerative geometry and knot invariants”, Marcos Marino, [hep-th/0210145](#).

About the String Theory Distinguished Visiting Lectureship:

This program is aimed at presenting the work of scholars, who have made contributions with lasting impact, to lecture on that subject at a pedagogical level so that they may be appreciated by wide spectrum of scholars and students at UW-Madison. Unlike the weekly seminars which aim to concisely communicate the recent developments, these lectures will be arranged in a series format to provide sufficient time to cover the subject at greater depth and completeness.