

# *Virtual Institute of Physics*

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Lectures on: Introduction to the superstrings  
by: **Mirian Tsulaya (University of Liverpool, UK)**  
will be held in the: **Lecture hall of „Kvali“ association**  
2<sup>nd</sup> block of Tbilisi State University, 3 Chavchavadze Ave.  
time: **Tuesdays 14:00** (lectures) **Thursdays 14:00**  
(exercises)

Master students are invited to attend

Course language: English/Georgian at the discretion of the audience

## 1. Introduction

## 2. Free Bosonic String

- Action
- Equations of motion
- Closed string
- States of the closed string
- Open string
- Vacuum Energy
- Theta functions
- $SL(2, Z)$  group, physical applications
- Assymptotic expressions for the density of states

## 3. Superstrings

- Action
- Spectrum

- Closed superstring partition function
- Low energy spectrum - type IIA and type IIB
- p-branes

#### 4. Open Strings

- Bosonic string
- Mobius strip, Klein bottle and Cylinder amplitudes
- Orientifolds

#### 5. Toroidal Compactifications

- Toroidal compactifications
- T-duality

#### 6. Heterotic string

- Partition function,
- Spectrum

#### 7. Path Integral formulation

#### 8. Topics in Conformal Field Theory

#### 9. String Scattering Amplitudes

- Veneziano amplitude
- Shapiro-Virasoro amplitude

#### 10 Low energy effective action