

# **Scientific Programme**

**ICTP Summer School**

**Modern Trends in Theoretical Condensed Matter Physics:  
From Low-Dimensional Nanoscale Systems to Advanced  
Materials for Photovoltaic**

May 18 - 29, 2015

**Khiva, Uzbekistan**

## Day 1, May 18

8:30-9:30	<i>Registration and coffee</i>
9:30-10:00	<i>Opening Ceremony. Greetings by Director of ICTP Summer School and by Director of Khorezm Mamun Academy</i>
<b><u>Morning Session</u></b> Quantum dots. Strongly correlated and strongly disordered superconductivity <b>Chair:</b> Boris Altshuler	
10:00-11:30	Igor Lerner. Interacting fermion-boson systems in one dimension
11:30-13:00	Alexei Kavokin. Bosonic laser: concept and realisation
<b>Lunch break (13:00-14:00)</b>	
<b><u>Afternoon Session</u></b> Strongly correlated and strongly disordered superconductivity <b>Chair:</b> Vladimir Yudson	
14:00-15:30	Vladimir Kravtsov. Multifractality of random wave functions: from superconductivity to work distribution in driven systems
<b>Coffee Break (15:30-16:00)</b>	
16:00-17:30	Jongbae Hong. Universal Tunnelling Conductance Formula for Strongly Correlated Materials
<b>Dinner (19:00-20:30)</b>	

## Day 2, May 19

<b><u>Morning Session</u></b> Novel superconductors. Strongly correlated systems <b>Chair:</b> Anvar Zakhidov	
9:30-11:00	Boris Altshuler. Anderson Localization
<b>Coffee Break (11:00-11:30)</b>	
11:30-13:00	Alexei Kavokin. Bosonic laser: concept and realization
<b>Lunch break (13:00-14:00)</b>	
<b><u>Afternoon Session</u></b> Strongly correlated and strongly disordered superconductivity <b>Chair:</b> Alexei Kavokin	
14:00-15:30	Vladimir Kravtsov. Multifractality of random wave functions: from superconductivity to work distribution in driven systems
<b>Coffee Break (15:30-16:00)</b>	
16:00-17:30	Igor Lerner. Interacting fermion-boson systems in one dimension
<b>Dinner (19:00-20:30)</b>	

### Day 3, May 20

<b><u>Morning Session</u></b> Strongly correlated and strongly disordered superconductivity <u>Chair:</u> Giuseppe Eramo	
9:30-11:00	Boris Altshuler. Anderson Localization
<b>Coffee Break (11:00-11:30)</b>	
11:30-12:15	Edip Niver. 3D Printed Electrically Small Antenna Optimization
12:15-13:00	Iman Askerbeyli. Multiband and anisotropy effects in Fe based superconductors
<b>Lunch break (13:00-14:30)</b>	
<b><u>Afternoon Session</u></b> Strongly correlated and strongly disordered superconductivity <u>Chair:</u> Bekir S. Kandemir	
14:30-15:30	Alexander Zinovev. Ion Beam Analysis: From Solar System Exploration to Solar Cell Design
15:30-16:00	Ilya Kulagin. High Harmonic Generation of Laser Radiation in Plasma Plume
<b>Coffee Break (16:00-16:30)</b>	
16:30-18:00	Victor Gurarie. Topological insulators and topological states of matter
<b>Dinner (19:00-20:30)</b>	

### Day 4, May 21

<b><u>Morning Session</u></b> Physics and technological perspectives of graphene <u>Chair:</u> Fatkhulla Abdullaev	
9:30-11:00	Vladimir Yudson. Transport in non-Galileayn-Invariant Electron Systems
<b>Coffee Break (11:00-11:30)</b>	
11:30-13:00	Davron Matrasulov. Supercritical phenomena in graphene induced by charged impurities
<b>Lunch break (13:00-14:00)</b>	
<b><u>Afternoon Session</u></b> Photovoltaic materials. Nonlinear dynamics <u>Chair:</u> Vladimir Kravtsov	
14:00-15:30	Giuseppe Eramo. From Dye Solar Cells to Perovskites: a new era for mesoscopic photovoltaics. General Overview of Recent Accomplishments
<b>Coffee Break (15:30-16:00)</b>	
16:00-17:30	Vladimir Kravtsov. Multifractality of random wave functions: from superconductivity to work distribution in driven systems
<b>Dinner (19:00-20:30)</b>	

## Day 5, May 22

<b><u>Morning Session</u></b> Topological effects in condensed matter physics. Physics and technological perspectives of graphene <b>Chair:</b> Reinhard Scholz	
9:30-11:00	Victor Gurarie. Topological insulators and topological states of matter
<b>Coffee Break (11:00-11:30)</b>	
11:30-13:00	Takehito Yokoyama. Spin and valley transports in Dirac systems
<b>Lunch break (13:00-14:00)</b>	
<b><u>Afternoon Session</u></b> Nonlinear dynamics <b>Chair:</b> Igor Lerner	
14:00-15:30	Zarif Sobirov. Nonlinear evolution equations on networks
<b>Coffee Break (15:30-16:00)</b>	
16:00-17:30	Chul-Hong Park. Bistability of Hydrogen Impurity in ZnO under Light illumination
<b>Dinner (19:00-20:30)</b>	

## Day 6, May 23

<b><u>Morning Session</u></b> Physical and Technological Perspectives of graphene <b>Chair:</b> Anvar Zakhidov	
9:30-11:00	Bekir S. Kandemir. An Analogue Model of a Black Hole in Graphene
<b>Coffee Break (11:00-11:30)</b>	
<b><u>Special Session</u></b> <i>Contribution of Medieval Khorezmian Scholars to World's Science and Technology</i>	
11:30-12:15	Davron Matrasulov. Al Khorezmi as Great Mathematician of Medieval Times
12:15-13:00	Qudrat Masharipov. Outstanding Contribution of Al Beruni to World's Science
<b>Lunch break (13:00-14:00)</b>	
<b>Excursion in the Urgench City (15:30-19:00)</b>	
<b>Dinner (19:00-20:30)</b>	

## Day 7, May 24, Sunday:

<p style="text-align: center;"><b><u>Free day for informal communications,</u></b> <b>Sightseeing in Khiva,</b> <b><u>Excursions to Samarkand and Bukhara</u></b></p>
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## Day 8, May 25

<b><u>Morning Session</u></b> Density functional theory and photovoltaic materials. Nonlinear dynamics <u>Chair:</u> Vladimir Dyakonov	
9:30-11:00	Nicola Seriani. Fundamental materials research for solar-energy applications
<b>Coffee Break (11:00-11:30)</b>	
11:30-13:00	Fatkhulla Abdullaev. Solitons in spin-orbit coupled Bose-Einstein condensates
<b>Lunch break (13:00-14:30)</b>	
<b><u>Afternoon Session</u></b> Nonlinear Dynamics <u>Chair:</u> Thomas Riedl	
14:30-16:00	Bakhodir Abdullaev. Observed hidden magnetic order as pseudogap and superconductivity pairs and set of underdome metal-insulator-crossover phenomena as keystone of physics of cuprates
<b>Coffee Break (16:00-16:30)</b>	
16:30-16:55	S. Mehdi Vaez Allaei. Nanoscale Heat Transport and Thermal Diodes: Molecular Dynamics Simulations.
16:55-17:20	Javad Vahedi. Heat dissipation in single-molecular junction
17:20-17:45	Neslihan Gökçek. Tuning anisotropic Fermi velocity in graphene by electron-phonon interactions
<b>Dinner (19:00-20:30)</b>	

## Day 9, May 26

<b><u>Morning Session</u></b> Density functional theory and photovoltaic materials. <u>Chair:</u> Giulio Casati	
9:30-11:00	Vladimir Dyakonov. Fundamental Processes in Organic and Hybrid Thin-film Photovoltaics
<b>Coffee Break (11:00-11:30)</b>	
11:30-13:00	Anvar Zakhidov. Physical Processes of Photoexcitations in Hybrid Perovskite Solar Cells: Dynamics of Carriers and Excitons, Polarons and Mobility, Magnetic Field Effects
<b>Lunch break (13:00-14:00)</b>	
<b><u>Afternoon Session</u></b> Nonlinear Dynamics. Density functional theory <u>Chair:</u> Edip Niver	
14:00-15:30	Giulio Casati. Classical dynamical localization
<b>Coffee Break (15:30-16:00)</b>	
16:00-17:30	Nicola Seriani. An introduction to Density Functional Theory
<b>Dinner (19:00-20:30)</b>	

## Day 10, May 27

<b><u>Morning Session:</u></b> Density functional theory and photovoltaic materials. <u>Chair:</u> Jongbae Hong	
9:30-11:00	Thomas Riedl. Charge transport at interfaces in organic and perovskite solar cells
<b>Coffee Break (11:00-11:30)</b>	
11:30-13:00	Anvar Zakhidov. Physical Processes of Photoexcitations in Hybrid Perovskite Solar Cells: Dynamics of Carriers and Excitons, Polarons and Mobility, Magnetic Field Effects
<b>Lunch break (13:00-14:30)</b>	
<b><u>Afternoon Session</u></b> Density functional theory and photovoltaic materials. Physics and technological perspectives of graphene <u>Chair:</u> Nicola Seriani	
14:30-16:00	Reinhard Scholz. Charge transfer states in molecular blends: The physics behind the open circuit voltage of organic photovoltaic devices
<b>Coffee Break (16:00-16:30)</b>	
16:30-17:15	Aikaterini Mandilara. The essentially entangled subspace of inseparable quantum states
17:15-17:40	Doniyor Babajanov. Particle transport on zigzag graphene nanoribbon under ultrashort pulses
<b>Dinner (19:00-20:30)</b>	

## Day 11, May 28

<b><u>Morning Session</u></b> Short talks by young researches <u>Chair:</u> Davron Matrasulov	
9:30-9:55	Ramzan Ullah. Thz&Fourier Transform Infrared (Near, Mid and Far) Spectroscopy of "Bisphenol A"
9:55-10:20	Usmon Sapaev. Second harmonic generation in 2D nonlinear photonic crystals with arbitrary structures
10:20-10:55	Saparboy Rakhmonov. Quantum dynamics of atom in time-dependent billiards
<b>Coffee Break (10:55-11:25)</b>	
11:25-11:50	Jambul Yusupov. Directed transport in quantum graphs
11:50-12:15	Alireza Habibi. Conformal symmetry in 2D disordered Anderson Model in presence of spin-orbital interactio
12:15-12:40	Rasoul Ghadimi. Effect of angular momentum of light in interaction with Dirac matter.
<b>Lunch break (13:00-14:00)</b>	
<b><u>Afternoon Session</u></b> (14:00-17:00) <i>Poster presentations</i>	

**Day 12, May 29**

<b><u>Morning Session</u></b>	
9:30-12:30	Topical seminars and round tables
12:30-13:00	Closing of the Conference Ceremony of Awards for best Poster
<b>Lunch break (13:00-14:00)</b>	