



Annual Report 2014

Introduction

ICTP – Eurasian Centre for Advanced Research (ECAR) is designed as an international centre to serve as a “meeting point” for the scientists, researchers and students of the broad Eurasia region. It is one of the five regional [partner institutions](#) of ICTP ([International Centre for Theoretical Physics](#)) that operates with high standards of scientific merit and a mission of fostering the science in developing regions of the globe for the last 50 years. IZTECH ([Izmir Institute of Technology](#)) is hosting ICTP-ECAR. The collaboration of ICTP and IZTECH has started back in 2012, and is based on a [Memorandum of Understanding](#).

ICTP-ECAR has started its scientific activities in 2014. The Inauguration Conference organized during 5-7 May 2014 marked the official starting point of this new international Centre.

ICTP-ECAR activities are held at the IZTECH campus. Offices of ICTP-ECAR are located on the first floor of the Department of Mathematics Building. Currently, there are three IZTECH personnel dedicated for the administrative needs of the Centre.

2014 Director’s Annual Report is composed of four sections:

- Organisation and Members
- Inauguration Conference
- Scientific Activities
- List of ICTP-ECAR Visitors

In the next few years, the establishment of ICTP-ECAR will be consolidated by inclusion of several research and activity programs and by diversifying its funding sources. One of the priority targets of the Centre will be to acquire the “Category II Institute” label of UNESCO. Continuous support of friends and partners of ICTP-ECAR is crucial for those goals.

Sincerely,
Prof. Tuğrul Senger
Acting Director

<http://ictp-ecar.org>

Organization and Members

Administrative bodies of ICTP-ECAR are the Steering Committee and the Scientific Council. Local coordination of the Centre with the host institution is managed by a unit established under the Rectorate of IZTECH.

Steering Committee

Fernando Quevedo, ICTP Director	Steering Committee Chairman (Ex Officio),
Mustafa Güden, IZTECH Rector	Steering Committee Member (Ex Officio),
Efthimios Kaxiras, Harvard University	Steering Committee Member,
Serdar Sarıçiftçi, Johannes Kepler University	Steering Committee Member,
Cumrun Vafa, Harvard University	Steering Committee Member,
Seifallah Randjbar-Daemi, ICTP	Steering Committee Coordinator (Ex Officio),

Scientific Council

Gabriel Aeppli, (Chairman), London Centre for Nanotechnology
Ignatios Antoniadis, CERN
Baha Balantekin, University of Wisconsin-Madison
Nihat Berker, Sabancı University
Athanasios Fokas, University of Cambridge
Ramin Golestanian, University of Oxford
Rahmi Güven, Boğaziçi University
Klaus von Klitzing, MPI-Stuttgart
Seifallah Randjbar-Daemi, (Ex Officio), ICTP
Mehmet Sarıkaya, University of Washington
Manfred Sigrist, ETH Zürich

Inauguration Conference (5-7 May)

Before the start of the conference, first closed meetings of Steering Committee and Scientific Council of ICTP-ECAR were held on the fifth of May 2014. Inauguration conference started with opening ceremony and ceremonial talks, and continued with a cocktail. On the second and third days of the conference, ICTP-ECAR Steering Committee and Scientific Council members, and other distinguished scientists gave colloquium style talks of 30 minutes.

350 people attended the conference, mainly from Turkey, but also there were many visitors from the countries of the region. Invited speakers and titles of their talks are listed below:

Mehmet Sarıkaya, *University of Washington*

“Molecular Biomimetics: Joining Biology and Engineered Materials at the Molecular Scale for Technology and Medicine”

Ramin Golestanian, *University of Oxford*

“Making Living Matter From The Bottom Up”

Allan MacDonald, *University of Texas at Austin*

“New Physics in Two-Dimensional Materials”

N. Serdar Sariçiftçi, *Johannes Kepler University of Linz*

“Solar Energy and Democratization of Energy Supply”

Manfred Sigrist, *ETH Zurich*

“From Superfluid He-3 to Topological Superconductors”

Rahmi Güven, *Bogazici University*

“99 Years of General Relativity”

Baha Balantekin, *University of Wisconsin-Madison*

“What do Neutrinos Tell Us About the Universe?”

Ignatios Antoniadis, *CERN*

“Particle Physics at CERN”

Vahid Karimipour, *Sharif University of Technology*

“Quantum Information, Advancement in Technology and Our Understanding of Quantum Phenomena”

Gabriel Aeppli, *London Centre for Nanotechnology*

“Why Quantum Many-Body Physics Matters For The Future of Computing”

Efthimios Kaxiras, *Harvard University*

“Multiscale Simulations of Materials: Exploring New Physics and Applications”

Klaus von Klitzing, *MPI-Stuttgart*

“From Quantum Hall Effect to a New System of Units”

Scientific Activities 2014

There has been a summer school, an advanced workshop and several seminars and a colloquium organized at ICTP-ECAR.

1. School

II. International Summer School on Exact and Numerical Methods for Low-Dimensional Quantum Structures (23-31 August)

This summer school aimed to provide an in-depth overview of the low-dimensional systems with a particular, but not exclusive, emphasis on the Bethe ansatz.

More details are described on the web page of the school: <http://ictp-ecar.org/events/ii-international-summer-school-on-exact-and-numerical-methods-for-low-dimensional-quantum-structures/>

Scientific Committee

Natan Andrei (Rutgers University, New Brunswick, USA)

Jean Sebastian Caux (University of Amsterdam, Netherlands)

Balázs Dora (Budapest University of Technology and Economics, Budapest, Hungary)

Henrik Johannesson (Gothenburg University, Sweden)

Vladimir Korepin (State University of New York, Stony Brook, USA)

Itzhak Roditi (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil)

Organizing Committee

Özgür Çakır (IZTECH, Izmir, Turkey)

Hans-Peter Eckle (University of Ulm, Germany)

Devrim Güçlü (IZTECH, Izmir, Turkey)

Balázs Hetényi (Bilkent University, Ankara, Turkey)

Haldun Sevinçli (IZTECH, Izmir, Turkey)

Lecturers of the Summer School

Natan Andrei (Rutgers University, New Brunswick, USA)

Hans-Peter Eckle (University of Ulm, Germany)

Frank Göhmann (Bergische University, Wuppertal, Germany)

Balázs Hetényi (Bilkent University, Ankara, Turkey)

Örs Legeza (Wigner Institute, Budapest, Hungary)

Bernhard Nienhuis (Free University of Amsterdam, The Netherlands)

Itzhak Roditi (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil)

Lea Santos (Yeshiva University, New York, USA)

Each morning and each afternoon consisted of two 85 minute lectures for 8 days, and there were 30-minute presentations by participants during the school. There were also exercise sessions in the evening involving applications of the lectures. There were 8 lecturers and 14 participants of the summer school (11 male and 3 female). Participants came from 6 different countries: Turkey (5), Germany (4), Algeria (2), Belgium (1), South Africa (1), and Hungary (1).

2. Workshop

Advanced Workshop on Landau-Zener Interferometry and Quantum Control in Condensed Matter (29 September – 03 October)

The workshop addressed recent developments on Landau-Zener dynamics and related quantum control in complex systems including (but not limited to) many body effects in ultracold gases, dissipative Landau-Zener transitions, Landau-Zener interferometry in superconducting qubits, double and triple quantum dots, spin & charge qubits, N-V centers...

More details are described on the web page of the workshop: <http://ictp-ecar.org/events/workshop/>

Organizing Committee

Immanuel Bloch (LMU & MPQ, Germany)
 Özgür Çakır (IZTECH, Turkey)
 Devrim Güçlü (IZTECH, Turkey)
 Mikhail Kiselev (ICTP, Italy)
 Stefan Ludwig (LMU, Germany)
 Peter Nalbach, (U. Hamburg, Germany)
 Tuğrul Senger (IZTECH, Turkey)
 Haldun Sevinçli (IZTECH, Turkey)

Invited Speakers

Dimitris Angelakis (TU Crete, Greece + Center for Quantum Technologies, Singapore)
 “Quantum Simulations of Condensed Matter and Exotic Phenomena with Strongly Correlated Photons and Polaritons”

Alexander Atland (Institute for Theoretical Physics, University of Cologne, Germany)
 “Echo Spectroscopy of Anderson Localization”

Pierre Barthelemy (TU Delft, the Netherlands)
 “Quantum Simulations with Quantum Dots Arrays”

Guido Burkard (University of Konstanz, Germany)
 “Landau-Zener Quantum Memory and All-Optical Quantum Control in NV Centers”

Aashish Clerk (McGill University, Canada)
 “Photon-assisted Tunnelling with Non-classical Light”

Yuval Gefen (Weizmann Institute of Science, Israel)
 “SU (2) Generalization of the Ambegaokar-Eckern-Schoen Action: Geometric Langevin Noise”

Steven Girvin (Yale University, USA)
 “Recent Progress in Circuit QED”

Peter Hänggi (Universität Augsburg, Germany)
 “Sweep a Qubit to Entangle States and to Gauge its Environment”

Andreas Hemmerich (Institut für Laserphysik, Universität Hamburg, Germany)
 “Band Crossing Dynamics with Superfluid Bosons”

Menderes Işkın (Koç University, Turkey)
 “Stripe-ordered Superfluid, Supersolid and Vortex Lattice phases in Attractive Hofstadter-Hubbard Model”

Mikhail N. Kiselev (ICTP, Italy)

“Landau - Zener Interferometry in Multilevel Systems”

Sigmund Kohler (Instituto de Ciencia de Materiales de Madrid, Spain)

“Landau-Zener-Stückelberg Interferometry: A Tool for Measuring Decoherence”

Mikhail Lukin (Harvard University, USA)

“Nanoscale Magnetic Sensing via Multi-Particle Interferometry”

Florian Marquardt (Institute for Theoretical Physics II / University of Erlangen-Nuremberg, Germany)

“Time-dependent Control of Light and Sound”

Gilles Montambaux (Université Paris-Sud, France)

“Probing Physics of Dirac Cones by Landau-Zener Interferometry”

Oliver Morsch (University of Pisa, Italy)

“From Generalized Landau-Zener Protocols to Transitionless Quantum Driving”

Mehmet Özgür Öktem (Bilkent University, Turkey)

“Landau-Zener Transitions Between Topological and Ordinary Insulators”

William D. Oliver (MIT, USA)

“Coherent Landau-Zener Transitions in Superconducting Qubits: Interferometry, Spectroscopy, Cooling, and Control”

Jukka Pekola (Aalto University, Finland)

“Quantum Thermodynamics in Superconducting Circuits”

Thomas Pohl (Max-Planck-Institute for the Physics of Complex Systems, Germany)

“Many-Body Control of Effective Quantum Magnets from Rydberg Atom Lattices”

Anatoli Polkovnikov (Boston University, USA)

“Nontrivial High Frequency Limits in Periodically Driven Systems”

Andrew Sachrajda (National Research Council of Canada, Canada)

“Landau-Zener-Stückelberg (LZS) Interferometry in Triple Quantum Dots”

Ulrich Schneider (Ludwig-Maximilians-Universität, Germany)

“Stückelberg Interferometry in a Hexagonal Lattice”

Sergey Shevchenko (Kharkov State University, Ukraine)

“Direct and Inverse LZS Interferometry and Their Application for Nano-electro-mechanical Systems”

Tim Taminiau (TU Delft, the Netherlands)

“Quantum Networks and Quantum Information with Spins in Diamond”

Richard J. Warburton (University of Basel, Switzerland)

“Manipulating the Nuclear Spins in a Semiconductor Quantum Dot with Frequency-Swept Magnetic Resonance Pulses”

Eva Weig (University of Konstanz, Germany)

“Coherent Control of Strongly Coupled Nanomechanical Modes”

In addition to talks by invited speakers, there were also several short talks by

Peter Nalbach (Universität Hamburg, Germany)

“Dissipative Quantum Dynamics at Avoided Crossings”

Daniel Dominguez (Centro Atomico Bariloche and Instituto Balseiro, Argentina)

“Quantum Bath Engineering in Landau-Zener-Stuckelberg Interferometry”

Florian Forster (Center for Nanoscience and Fakultät für Physik, LMU-München, Germany)

“Characterization of Qubit Dephasing by Landau-Zener-Stückelberg-Majorana Interferometry”

The workshop lasted 5 days through which each invited speaker gave a 45-minute talk. There were two poster sessions in the first two days after the talks. There was also a free discussion session on the fourth day. A half day excursion to Ephesus was organised for the speakers and participants of the workshop.

There were 27 participants of the workshop (11 female, 16 male) coming from 7 different countries: Turkey (13), Germany (6), Canada (3), Iran (2), Argentina (1), Slovak Republic (1), and USA (1).

3. Seminars

3.1. Seminar by Prof. Tamerlan Magkoev (September 11)

(Head of Nanophysics and Nanotechnology Research Center, University of North Ossetia, Vladikavkaz, Russian Federation)

Title: Through Fundamental Interdisciplinary Insights into Molecular Surface reaction to Heterogeneous Catalysis, Thin Film and Nanomaterial Design, and Cancer Treatment

3.2. Seminar by Dr. Güneş Söyler (October 10)

(Max Planck Institute, Dresden, Germany)

Title: Quantum Many-body Phases of Interacting Photons and Atoms

4. Colloquium

Assessment and Design of Material Systems for Energy Harvesting, Conversion and Storage (October 13)

Prof. Tahir Çağın (Department of Materials Science and Engineering, Texas A&M University, USA)

Visitors of ICTP-ECAR in 2014

Name	Home Institution	Period of Visit
Ignatios Antoniadis	CERN, Switzerland	May 4-6
Mehmet Sarıkaya	University of Washington, USA	May 4-6
Efthimios Kaxiras	Harvard University, USA	May 4-6
Ramin Golestanian	University of Oxford, UK	May 4-6
Baha Balantekin	University of Wisconsin-Madison, USA	May 3-7
Serdar Sarıçiftçi	Johannes Kepler University, Austria	May 4-7
Gabriel Aeppli	London Centre for Nanotechnology, UK	May 4-6
Klaus von Klitzing	MPI-Stuttgart, Germany	May 4-7
Manfred Sigrüst	ETH Zürich, Switzerland	May 4-6
Rahmi Güven	Boğaziçi University, Turkey	May 4-7
Seifallah Randjbar-Daemi	ICTP, Italy	May 4-7
Fernando Quevedo	ICTP, Italy	May 4-6
Nihat Berker	Sabancı University, Turkey	May 4
Vahid Karimipour	Sharif University of Technology, Iran	May 5-7
Allan MacDonald	The University of Texas at Austin, USA	May 5-7
Afif Siddiki	İstanbul University, Turkey	May 5-7
Hamlet Isahanlı	Khazar University, Azerbaijan	May 5-7
Tayfun Özçelik	Turkish Academy of Sciences / Bilkent University, Turkey	May 5-7
Hikmet Üçışık	Islamic Academy of Sciences	May 5-7
Mehmet Zeyrek	METU, Turkey	May 5-7
Namık Kemal Pak	METU, Turkey	May 5-7
Tuğrul Hakiöğlü	Bilkent University, Turkey	May 5-7
Alex Kehagias	National Technical University of Athens, Greece	May 5-7
Oğuz Gülseren	Bilkent University, Turkey	May 5-7
Asaf Hacıyev	Azerbaijan Academy of Sciences, Azerbaijan	May 5-7
Livius Trache	İFİN-HH Bucharest, Romania	May 5-7
Neda Bostani	American Association for the Advancement of Science	May 5-7
Reza Mansouri	IPM, Iran	May 5-7
Natan Andrei	Rutgers University, USA	Aug 25-Sept 4
Hans-Peter Eckle	University of Ulm, Germany	Aug 20-Sept 1
Frank Göhmann	Bergische University, Germany	Aug 22-29
Balazs Hetényi	Bilkent University, Turkey	Aug 20-31
Örs Legeza	Wigner Institute, Hungary	Aug 21-28
Bernhard Nienhuis	Free University of Amsterdam, Holland	Aug 22-Sept 1
Itzhak Roditi	Centro Brasileiro de Pesquisas Fisicas, Brazil	Aug 26-31
Lea Santos	Yeshiva University, New York, USA	Aug 25-31
Tamerlan Magkoev	University of North Ossetia, Russian Federation	Sept 11
Dimitris Angelakis	Center for Quantum Technologies, Singapore	Sept 28-30
Alexander Atland	University of Cologne, Germany	Oct 1-3
Pierre Barthelemy	TU Delft, The Netherlands	Sept 29-Oct 4
Guido Burkard	University of Konstanz, Germany	Sept 30-Oct 5
Aashish Clerk	McGill University, Canada	Sept 28-Oct 3
Yuval Gefen	Weizmann Institute of Science, Israel	Oct 1-2
Steven Girvin	Yale University, USA	Sept 27-Oct 3
Peter Hänggi	University of Augsburg, Germany	Sept 28-Oct 3
Andreas Hemmerich	Universität Hamburg, Germany	Oct 1-4
Menderes Işkın	Koç University, Turkey	Sept 28-Oct 3
Sigmund Kohler	Instituto de Ciencia de Materiales de Madrid, Spain	Sept 28-Oct 3
Mikhail Lukin	Harvard University, USA	Sept 30-Oct 3
Florian Marquardt	University of Erlangen-Nuremberg, Germany	Sept 28-Oct 4

Gilles Montambaux	Université Paris-Sud, France	Sept 28-Oct 3
Mehmet Özgür Öktel	Bilkent University, Turkey	Sept 28-Oct 1
William D. Oliver	MIT, USA	Sept 28-Oct 4
Jukka Pekola	Aalto University, Finland	Sept 28-Oct 3
Thomas Pohl	Max-Planck-Inst. for the Physics of Complex Syst., Germany	Sept 27-Oct 2
Anatoli Polkovnikov	Boston University, USA	Sept 29-Oct 2
Andrew Sachrajda	National Research Council of Canada, Canada	Sept 28-Oct 4
Ulrich Schneider	Ludwig-Maximilians-Universität, Germany	Sept 30-Oct 4
Tim Taminiau	TU Delft, the Netherlands	Sept 29-Oct 3
Richard J. Warburton	University of Basel, Switzerland	Sept 29-Oct 1
Eva Weig	University of Konstanz, Germany	Sept 29-Oct 3
Oliver Morsch	University of Pisa, Italy	Sept 28-Oct 1
Sergey Shevchenko	Inst. for Low Temperature Physics and Eng., Ukraine	Sept 28-Oct 3
Immanuel Bloch	Ludwig-Maximilians-Universität, Germany	Sept 29-Oct 3
Stefan Ludwig	CeNS and LMU Munich, Germany	Sept 28-Oct 3
Peter Nalbach	Universität Hamburg, Germany	Sept 28-Oct 3
Mikhail Kiselev	ICTP, Italy	Sept 29-Oct 3
Florian Forster	LMU Munich, Germany	Sept 28-Oct 5
Daniel Dominguez	Centro Atomico Bariloche, Argentina	Sept 28-Oct 4
Güneş Söyler	Max Planck Institute, Germany	Oct 9-10
Tahir Çağın	Texas A&M University, USA	Oct 13