

## Summary of important FQMT'19 conference data and events

The conference Frontiers of Quantum and Mesoscopic Thermodynamics (FQMT'19) was held in Prague, Czech Republic at the Pyramida Hotel from July 14 to July 20, 2019.

FQMT'19 was a follow-up to the six previous, successful Prague conferences "Frontiers of Quantum and Mesoscopic Thermodynamics 2004" (FQMT'04), FQMT'08, FQMT'11, FQMT'13, FQMT'15, and FQMT'17. As in all previous FQMT conferences, the aim of FQMT'19 was to create a bridge between the fields of modern condensed matter physics, quantum optics, statistical physics and the quickly developing field of foundations of quantum physics.

### Scope

The main goal of the conference was to contribute to a better understanding of the behavior of quantum systems out of equilibrium. To reach this aim we also need to improve our knowledge of systems in equilibrium and steady state situations. The conference thus addressed foundations of quantum physics, quantum many body physics, statistical physics, and thermodynamics relying on the theoretical and experimental methods of condensed matter physics and quantum optics. The systems considered were mainly on the order of mesoscopic (nanoscale) size, and included those of both natural and artificial origin. Special attention was given to non-equilibrium quantum systems, physics of quantum information and manifestation of quantum effects in biological systems. Themes in astrophysics, gravitation and cosmology related to the above scope were also included.

### Topics

The organizers created a program which covered homogeneously the following topics:

- Non-equilibrium quantum phenomena
- Foundations of quantum physics
- Quantum measurement, entanglement and coherence
- Dissipation, dephasing, noise and decoherence
- Many body physics, quantum field theory
- Quantum statistical physics and thermodynamics
- Quantum optics
- Quantum simulations
- Physics of quantum information and computing
- Topological states of quantum matter, quantum phase transitions
- Macroscopic quantum behavior
- Cold atoms and molecules, Bose-Einstein condensates
- Mesoscopic, nano-electromechanical and nano-optical systems
- Biological systems, molecular motors and quantum biology
- Cosmology, gravitation and astrophysics

### Dedication

The conference was dedicated to Marlan Scully for his lifetime achievements in physics. The highest medal of the Academy of Sciences "De scientia et humanitate optime meritis" was awarded to Marlan by Eva Zažímalová, President of the Czech Academy of Sciences, during the special ceremony on Wednesday evening. The whole Thursday program was organized as a tribute to Marlan: a series of plenary talks and an afternoon round table, dealing with

themes of Marlan's lifelong scientific interests. Just before the round table there was a special session (accompanied by photos of Marlan) where he was remembered by his friends. The day dedicated to Marlan ended with a concert in the Saint Vitus Cathedral of the Prague Castle.

### **The Scientific Program**

The FQMT'19 conference was attended by 222 participants, approximately the same number of participants as the previous FQMT conference. The scientific program included 158 invited talks given by leading experts.

The poster session, held on Tuesday, consisted of 80 contributions (37 invited and 43 regular) and had, according to many participants, an excellent quality.

The round table of Thursday afternoon included five main panelists, namely: Marlan Scully, Wolfgang Ketterle, William Phillips, Gerard 't Hooft, and Rainer Weiss. Many other conference participants took part in the lively discussion.

The following leading experts accepted the invitation of the Scientific Committee, delivered their talks and discussed lively hot problems of the FQMT'19 topics during the whole conference:

*Hartmut Abele, Yoram Alhassid, Roland Allen, Frithjof Anders, Joachim Ankerhold, Mauro Antezza, Andrew Armour, Vanderlei Bagnato, Harold Baranger, Wolfgang Belzig, Yaroslav Blanter, Denys Bondar, Michael Bonitz, Dirk Bouwmeester, Warwick Bowen, Alessandro Braggio, Matteo Brunelli, Aurel Bulgac, Amir Caldeira, Jianshu Cao, Federico Capasso, Ana María Cetto, Frédéric Chevy, Andrew Cleland, Doron Cohen, Juan Carlos Cuevas, Bryan Dalton, Pawel Danielewicz, Luis de la Peña, Hansjoerg Dittus, Konstantin Dorfman, Igor Dotsenko, Ehtibar Dzhafarov, Jens Eisert, Sebastian Erne, Daniel Esteve, Jean Etesse, Jaroslav Fabian, Giuseppe Falci, Holger Fehske, Radim Filip, Boris Fine, James Freericks, Edward Fry, Stephen Fulling, Michael Galperin, Yuval Gefen, Nicolas Gisin, D. Christian Glattli, Sébastien Gleyzes, Michele Governale, Eberhard Gross, Michael Guidry, Shmuel Gurvitz, Walter Hahn, Peter Hänggi, Philip Hemmer, Ortwin Hess, Rudolf Hilfer, Petr Hořava, Bei-Lok Hu, Thibaut Jonckheere, Andrew Jordan, Kristen Kaasbjerg, Eytan Katzav, Peter Keefe, Wolfgang Ketterle, Andrei Khrennikov, Takafumi Kita, Stefan Klumpp, Olga Kocharovskaya, Jonne Koski, Ronnie Kosloff, Mario Krenn, Norbert Kroo, Gershon Kurizki, Paul Kwiat, Alfredo Levy Yeyati, Niels Lörch, Marcelo Lozada-Cassou, Jerzy Łuczka, Eric Lutz, Joseph Maciejko, Dominik Maile, Jiří Mareš, Thierry Martin, Mikko Möttönen, Lev Mourokh, Kater Murch, Evgenii Narimanov, Sylvain Nascimbene, Nir Navon, Daniel Neuhauser, Theo Nieuwenhuizen, Branislav Nikolic, Stefan Nimmrichter, Abraham Nitzan, Elisabetta Paladino, Hyunggyu Park, Jukka Pekola, Marti Perarnau-Llobet, Uri Peskin, Francesco Petruccione, Walter Pfeiffer, William Phillips, Fabrizio Piacentini, Arkady Plotnitsky, Haitao Quan, Friedemann Queisser, Saar Rahav, Ernst Rasel, Gianluca Rastelli, Jerome Rech, Linda Reichl, Yuri Rostovtsev, Gary Rozenman, Janne Ruostekoski, Amir Safavi-Naeini, David Sanchez, Rafael Sánchez, Lea Santos, Wolfgang Schleich, Thomas Schmidt, Peter Schmitteckert, Hans Schuessler, Lawrence Schulman, Marlan Scully, Udo Seifert, Dirk Semkat, Llorenç Serra, Armin Shayeghi, Daniel Sheehan, Yutaka Shikano, Efrat Shimshoni, Pascal Simon, Ilya Sinayskiy, Alexei Sokolov, Fernando Sols, Björn Sothmann, Václav Špička, Jürgen Stockburger, Fabio Taddei, Oren Tal, Gerard 't Hooft, Michael Thorwart, Thomas Udem, Yasuhiro Utsumi, Joan Vaccaro, Jan van Ruitenbeek, Claudio*

*Verdozzi, Denis Vion, Thomas Vojta, Thomas Walther, Rainer Weiss, Andrew White, Andrei Zaikin, Gergely Zarand, Vladimir Zelevinsky, Wei-Min Zhang.*

The FQMT'19 scientific program covered all conference topics. The talks, discussions after them, as well as the discussion during the round table and the poster session were found to be exceptionally inspiring by many conference participants.

### **Welcome Party**

On Monday, the first day of the conference, talks in the Pyramida Hotel were followed by a Welcome Party in the Wallenstein Palace, the seat of the Senate of the Parliament of the Czech Republic. At the beginning, the participants were welcomed by Eva Zažímalová, President of the Czech Academy of Sciences and Jiří Drahoš, Chairman of the Committee on Education, Science, Culture, Human Rights and Petition of the Senate and former President of the Czech Academy of Sciences.

### **Public Lectures and Awards**

In keeping with the tradition of the FQMT conferences, we had, apart from the regular talks, three exceptional public lectures and several awards. The public lectures were accompanied by concerts of classical music. These events were highly attended (not only by conference participants) and they were very much appreciated by the audience

First of all, on Tuesday evening the Mayor of Prague welcomed the participants of the FQMT'19 and gave a symbolic key of Prague to Rainer Weiss, who spent part of his childhood in Prague. The public lecture of William Phillips in the Pyramida Hotel Main Hall followed. The lecture, which included demonstrations with liquid nitrogen, was highly attended not only by the participants of the conference, but also the general public, including many children, who gratefully accepted the invitation to sit in the front.

Rainer Weiss and Wolfgang Ketterle delivered their public lectures in the National House of Vinohrady on Wednesday evening. During the event opening, the participants were welcomed by Jaroslav Kubera, President of the Senate of the Czech Republic, and Eva Zažímalová, President of the Czech Academy of Sciences. The opening also included award ceremonies: Jaroslav Kubera awarded the special medals of the Senate to Wolfgang Ketterle, William Phillips and Rainer Weiss for their exceptional contributions to the progress of science and Eva Zažímalová awarded the highest medal of the Czech Academy of Sciences "De scientia et humanitate optime meritis" to Marlan Scully for his lifetime achievements in science.

All three public lectures were very much appreciated not only by the conference participants, but also by the general public.

### **Concerts**

Following the tradition of the FQMT conferences, we had altogether four regular concerts of classical music during the conference week. Most of the concerts were again held at very exceptional places: in the Neo-Renaissance National House of Vinohrady, the Saint Vitus Cathedral of the Prague Castle where, before the concert, the participants of the conference listen to the welcome address of Archbishop of Prague, Cardinal Dominik Duka, and in the beautiful Baroque Basilica of the Assumption of the Virgin Mary of the Strahov Monastery. The concerts were played by exceptional Czech musicians, e.g. Luboš Hucek (bassoon), Pavel Hůla (violin), Tomáš Jindra (bass), Miroslav Kejmar (trumpet), Josef Kšica (organ, harpsichord),

Přemysl Kšica (organ), Jan Thuri (oboe), and Tomáš Víšek (piano), as well as Praga Camerata and Prague Brass Soloists ensembles.

### **Conference Dinner**

The conference dinner was on Friday in the rooms of the ancient Premonstratensian Strahov Monastery. Before the dinner, the director of the famous Strahov Library, Evermod Gejza Šidlovský delivered a welcome address and guided the conference participants through the Library and other interesting rooms of the Monastery. The conference dinner was combined with the concert in the Basilica of the Assumption of the Virgin Mary of the Strahov Monastery. At the beginning of the dinner, its participants were shortly welcomed by Eva Zažímalová, President of the Czech Academy of Sciences and Jan Řídký, Vice-President of the Academy of Sciences and former Director of the Institute of Physics of the Academy of Sciences.

### **Apollo session and the conference closing**

The conference ended on Saturday afternoon. The last session of the conference was dedicated to the 50th anniversary of the first Moon landing. Peter Keefe introduced the session with a brief overview of cosmonautics and then continued with the Apollo program; the main emphasis of his talk was on the Apollo 11 mission and the following flights to the Moon. The session was accompanied by live popular music motivated by the Moon played by Miroslav Kejmar (and his group of three other musicians) and by Tomáš Víšek (piano).

### **Summary**

The participants experienced a conference at a very high scientific level, all the while in a very warm atmosphere enhanced by the many artistic riches of Prague. Many participants considered the FQMT'19 scientific and social programs as a significant advancement in comparison with the previous FQMT conferences.

The FQMT'19 was broadly supported by Czech institutions and, on the other hand, by the participants, who graciously used their means for this aim. The event proved to be very valuable for the scientific climate in the Czech Republic, and the organizers express their gratitude for the support extended by leading Czech institutions, which certainly contributed to the high level and good atmosphere of the conference.

*Peter D. Keefe, Theo M. Nieuwenhuizen, and Václav Špička*