23rd SFB FoQuS Meeting

11./12.12.2013

Faculty of Physics, University of Vienna, Boltzmanngasse 5 / Strudlhofgasse 4, 1090 Wien
Lecture Room: Christian-Doppler-Hörsaal, 3rd floor

Wednesday, 11.12.2013		
13:30-13:55	Kiyotaka Aikawa	Degenerate dipolar Fermi gas of Erbium atoms
13:55-14:45	**Andrea Alberti**	**Exploring transport phenomena with discrete time quantum walks**
14:45-15:10	Poster Flash Talks	
15:10-16:15	Coffee Break with Poster Session	
16:15-16:40	Thomas Scheidl	Quantum entanglement at space scale
16:40-17:05	Adrien Feix	Quantum control of blackbox unitaries
17:05-17:30	Nicolai Friis	Fermions are not qubits – fermionic mode entanglement in quantum information
17:30-19:00	Christmas Market at Freyung (next to location of conference dinner, 15-20 minute walk or two tram stops from faculty of Physics building and hotels, see attached map)	
19:00	Conference Dinner	

Thursday, 12.12.2013		
08:30-09:20	Business Meeting (in IQOQI Seminar Room 2.08, Boltzmanngasse 3, 2nd floor)	
09:30-10:20	**Augusto Smerzi**	**Entanglement and distinguishability of quantum states**
10:20-10:45	Roohollah Ghobadi	Opto-mechanical micro-macro entanglement
10:45-11:35	Coffee Break with Poster Session	
11:35-12:05	Marco Mattioli	Cluster Luttinger liquids of Rydberg-dressed atoms in optical lattices
12:05-12:30	Michalis Skotiniotis	Improved quantum metrology using quantum error-correction
12:30-12:55	Ali Asadian	Probing macroscopic realism via Ramsey correlation measurements

Travel Information:

Trains on Wednesday from Innsbruck to Vienna – 7:08-12:04 (IC), **8:09-12:24 (RJ)**, 9:08-14:04 (IC)

Trains on Thursday from Vienna to Innsbruck – 13:36-17:51 (RJ), **13:56-18:51 (IC)**, 15:36-19:51 (RJ)

Exploring Transport Phenomena with Discrete Time Quantum Walks

Andrea Alberti

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Single atoms in optical lattices are a powerful resource to explore quantum interference phenomena. We will present our experimental approach to manipulate individual atoms in state-dependent optical lattices. A set of discrete operations allows us to process the quantum information, which is stored in the position and spin of the atoms. These operations can be assembled together as the basic building blocks of a richer quantum system, for instance, to design the interfering paths of a single atom interferometer in a fully digital fashion [1]. Matter wave interference can be extended from a simple Mach-Zehnder-like geometry to structured multipath geometries, as is the case of a discrete quantum walk of several tens of steps. This opens the way to studying quantum transport phenomena as the so-called “electric quantum walks,” which allow us to reproduce in a stroboscopic fashion the behavior of a charged particle in a crystal in the presence of an external electric field [2,3]. In a closely related vein, we have recently demonstrated a violation of Leggett-Garg inequality by measuring temporal correlations of quantum walks by means of ideal negative measurements. Detected violations up to 6 σ provide a rigorous test for the non-classicality of quantum motion of massive particles. Furthermore, systems of walking atoms hold promise for carrying out future transport experiments with few quantum-correlated particles [4].

[1]: A. Steffen, A. Alberti, W. Alt, N. Belmechri, S. Hild, M. Karski, A. Widera and D. Meschede, A digital atom interferometer with single particle control on a discretized spacetime geometry, PNAS **109**, 9770 (2012)
[2]: M. Genske, W. Alt, A. Steffen, A. H. Werner, R. F. Werner, D. Meschede, A. Alberti, Electric quantum walks with individual atoms, Phys. Rev. Lett. **110**, 190601 (2013)
[3]: C. Cedzich, T. Rybár, A. H. Werner, A. Alberti, M. Genske and R. F. Werner, Propagation of quantum walks in electric fields, Phys. Rev. Lett. **111**, 160601 (2013)
[4]: A. Ahlbrecht, A. Alberti, D. Meschede, V. B. Scholz, A. H. Werner, R. F. Werner, Molecular binding in interacting quantum walks, New. J. Phys., **14** 073050 (2012)

Entanglement and Distinguishability of Quantum States

Augusto Smerzi

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Entanglement is the mystery of Quantum Mechanics. Its most striking physical consequence is non-locality. We show that entanglement is also deeply connected to the concept of distinguishability of quantum states. Two systems can be more easily recognized to be different if they are quantum rather than classically correlated. This has important implications in technological applications like interferometry as well as in foundational problems as the quantum Zeno paradox.

Important Addresses

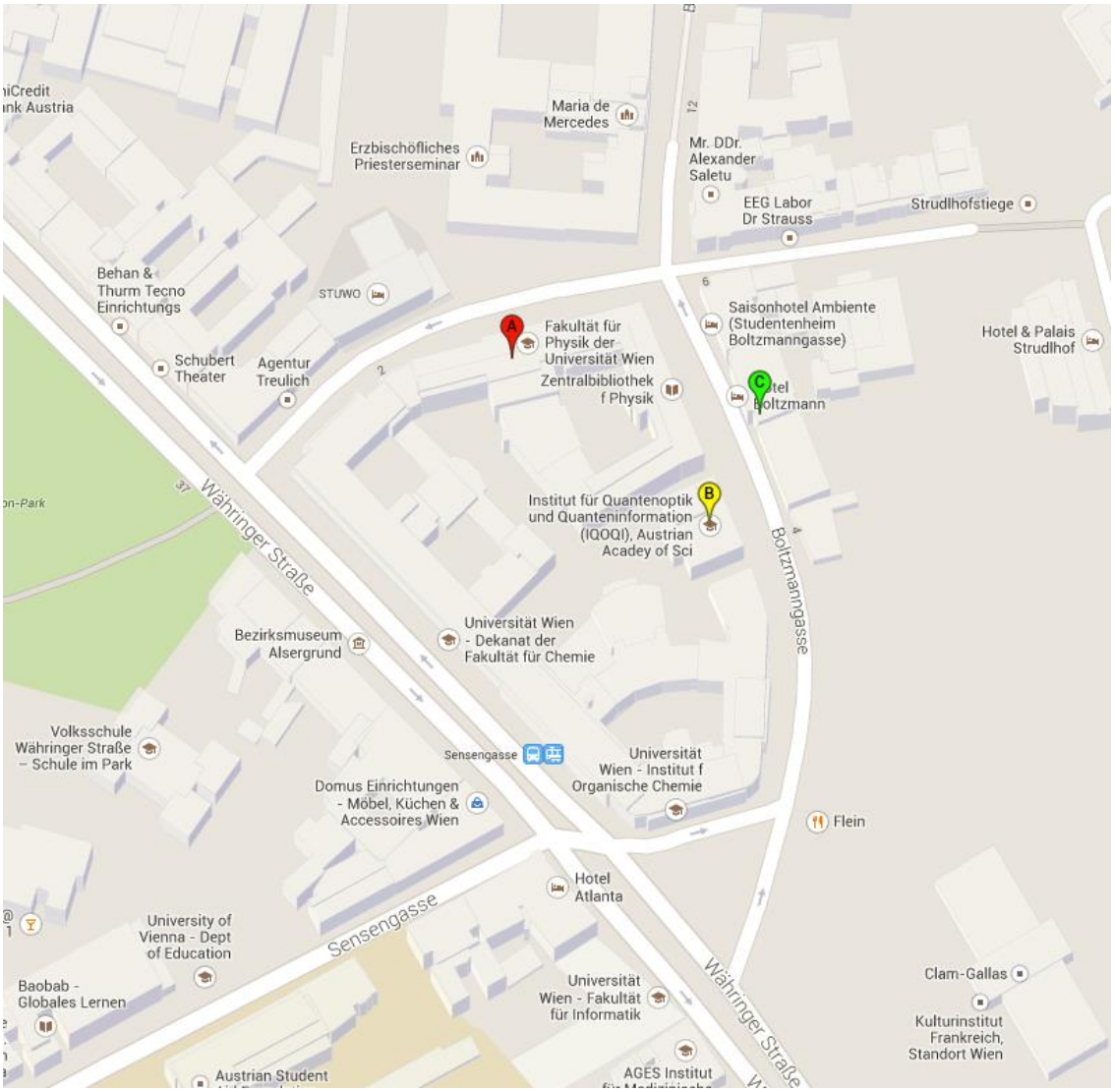
A Location of the SFB-Meeting:
Faculty of Physics, University of Vienna, Entrance at Strudlhofgasse 4, 1090 Wien
3rd floor, Christian-Doppler-Hörsaal

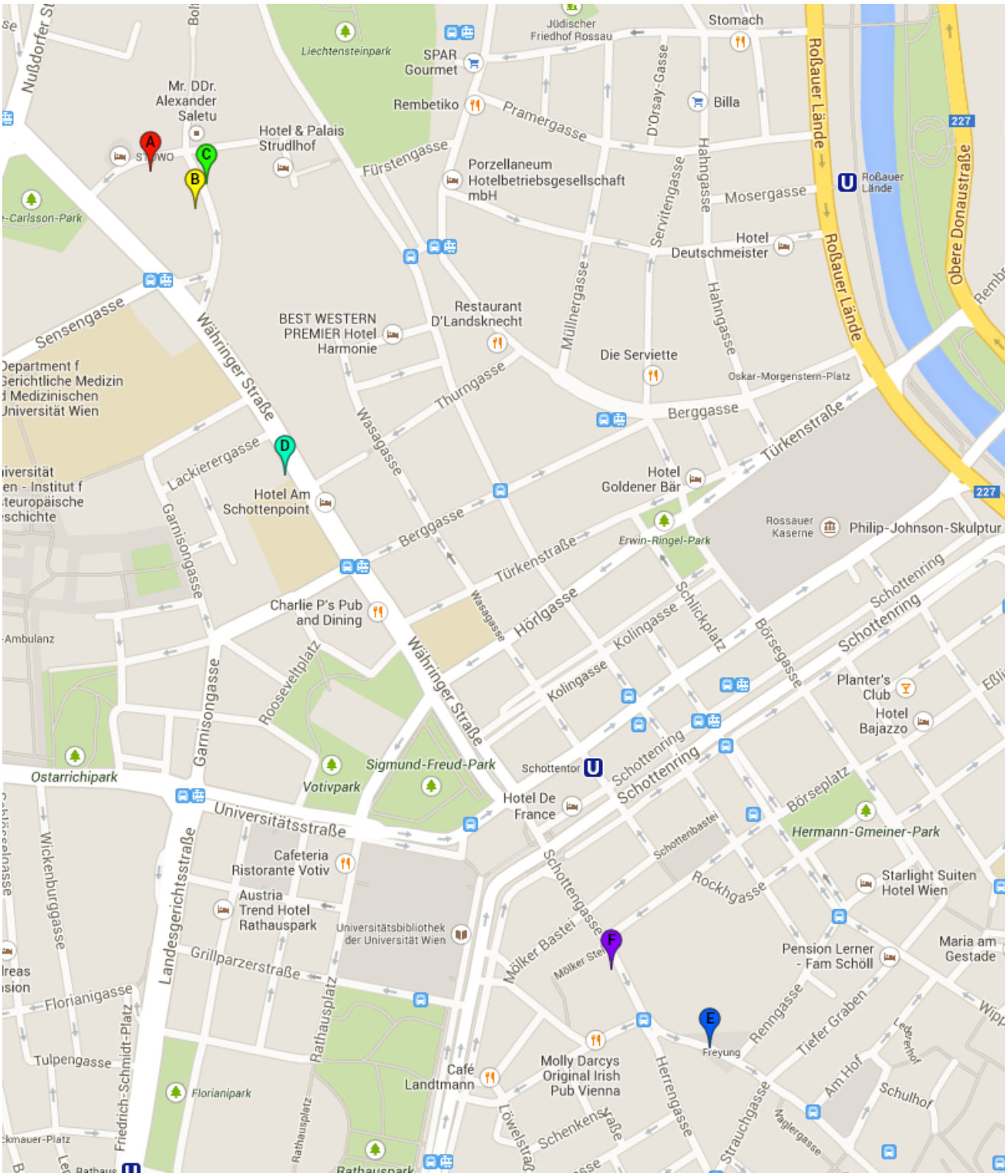
B Location of the SFB Business Meeting:
IQOQI Wien, Boltzmanngasse 3, 1090 Wien, 2nd floor, Seminar Room 2.08

Hotels:
C Hotel Boltzmann (www.hotelboltzmann.at), Boltzmanngasse 8, 1090 Wien
phone: +43-1-354-50-0
D Hotel Bleckmann (www.hotelbleckmann.at), Währinger Straße 15, 1090 Wien
phone: +43-01-408-08-99

E Christmas Market:
Altwiener Christkindlmarkt (www.altwiener-markt.at/start.html), Freyung, 1010 Wien

F Conference Dinner:
Melker Stiftskeller (www.melkerstiftskeller.at), Schottengasse 3, 1010 Wien

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F
Mr. DDr. Alexander Saletu
Hotel & Palais Strudlhof
Liechtensteinpark
SPAR Gourmet
Jüdischer Friedhof Rossau
Stomach
Billa
Rembetiko
Pramergasse
D'Orsay-Gasse
Fürstengasse
Porzellaneum Hotelbetriebsgesellschaft mbH
Hahngasse
Servitengasse
Mosergasse
Roßauer Lände
Obere Donaustraße
Hotel Deutschmeister
Sensengasse
Währinger Straße
BEST WESTERN PREMIER Hotel Harmonie
Restaurant D'Landsknecht
Müllnergasse
Die Serviette
Oskar-Morgenstern-Platz
Thurngasse
Wasagasse
Berggasse
Türkenstraße
Lackierergasse
Hotel Am Schottenpoint
Hotel Goldener Bär
Erwin-Ringel-Park
Rossauer Kaserne
Philip-Johnson-Skulptur
Garnisongasse
Charlie P's Pub and Dining
Hörlgasse
Kolingasse
Schlickplatz
Börsegasse
Schottenring
Roosevelteplatz
Ostarrichipark
Votivpark
Sigmund-Freud-Park
Schottentor
Planter's Club
Hotel Bajazzo
Universitätsstraße
Hotel De France
Börseplatz
Hermann-Gmeiner-Park
Schottenbastei
Cafeteria Ristorante Votiv
Austria Trend Hotel Rathauspark
Universitätsbibliothek der Universität Wien
Starlight Suiten Hotel Wien
Rockhgasse
Schottengasse
Wickenburggasse
Landesgerichtsstraße
Grillparzerstraße
Pension Lerner - Fam Schöll
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Florianigasse
Rathausplatz
Tulpengasse
Friedrich-Schmidt-Platz
Florianipark
Café Landtmann
Molly Darcys Original Irish Pub Vienna
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Renngasse
Tiefer Graben
Herrengasse
Am Hof
Schulhof
Schenkenstraße
Strauchgasse
Waglergasse