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Report on the

Doktoratskolleg Functional Matter (DK FunMat)

at Vienna University of Technology

Reporting period: Oct. 2008 - March 2011

Speaker: S. Bühler-Paschen, Institute of Solid State Physics

Co-speakers: U. Schubert, Institute of Materials Chemistry;
K. Unterrainer, Photonics Institute

Contents

Chapter 1

The DK FunMat students

The DK FunMat students are listed below, together with their thesis supervisor, the institute number, and the source of co-funding. Six out of 11 students are female.

1. Rupali DESHMUKH, Ulrich Schubert, E165, FWF project "Organically Modified Metal Alkoxide Precursors for Sol-Gel Processing" (P20750-N17)

2. Van An DU, Ulrich Schubert, E165, Shell Corp., The Netherlands

3. Dominik FISCHER, J. Schmiedmayer, E141, FFG Austrian NANO Initiative (PLATON - NAP project)

4. Christian KOLLER, J. Schmiedmayer, E141, EU (FET open) project MIDAS

5. Karl-Anton LORENZER, S. Bühler-Paschen, E138, ERC project QuantumPuzzle (227378)

6. Renate PAZOUREK, J. Burgdörfer, E136, FWF grant No. P21141-N16 (before: FWF grant No. SFB016)

7. Oliver PFÄFFLI, K. Unterrainer, E387, FWF SFB Infrared Optical Nanostructures - IR-ON (stopped his PhD work)

8. Georg ROHRINGER, E138, K. Held, E138, EU-Indian network MONAMI

9. Lubuna Beegum SHAFEEK, S. Bühler-Paschen, E138, FWF project EHK (P19458-N16)

10. Diana VOGEL, G. Rupprechter, E165, Fritz-Haber-Institut der Max-Planck-Gesellschaft, Berlin, Germany.

11. Li ZHANG, A. Baltuska, E387, FWF Project "Ultrafast Hydrogen Migration"

Chapter 2

Scientific publications by DK FunMat students

The following publications were co-authored by DK FunMat students (their names are underlined):

1. V. A. Du, S. O. Baumann, G. N. Stipicic, U. Schubert, "Cleavage of an Iron-Silicon Bond by Hexamethylphosphoric Triamide: Synthesis and Characterization of $[SiCl_3(HMPA)_3]^+[Fe(CO)_4SiCl_3]^-$", Zeitschrift für Naturforschung Section B - A Journal of Chemical Sciences **64b**, 1553-1557 (2009)

2. V. A. Du, G. N. Stipicic, M. Bendová, U. Schubert, "Formation of the silylene-bridged complex $Fe_2(CO)_6(\mu_2\text{-}SiCl_2)_3$ from *cis*-$Fe(CO)_4(SiCl_3)_2$: an experimental and computational study", Monatshefte für Chemie - Chemical Monthly **6**, 671-675 (2010)

3. V. A. Du, S. Gross, U. Schubert, "Re-investigation of the thermal decomposition of $Co(CO)_4SiCl_3$ adsorbed on silica", Chemical Communications **46**, 8549 - 8551 (2010)

4. V. A. Du, A. Sidorenko, S. Paschen, U. Schubert, "Iron silicide nanoparticles in a SiC/C matrix from organometallic polymers: characterization and magnetic properties ", submitted.

5. V. A. Du, G. N. Stipicic, U. Schubert; "^{29}Si NMR shielding calculations employing density functional theory with focus on hypervalent silicon compounds", submitted.

6. D. Heine, W. Rohringer, D. Fischer, M. Wilzbach, T. Raub, S. Loziczki, XiYuan Liu, S. Groth, B. Hessmo and J. Schmiedmayer, "A single-atom detector integrated on an atom chip: fabrication, characterization and application", New J. Phys. **12**, 095005 (2010)

7. W. Rohringer, D. Fischer, M. Trupke, J. Schmiedmayer and T. Schumm (2011). "Stochastic Optimization of Bose-Einstein Condensation Using a Genetic Algorithm", ISBN: 978-953-307-829-8,InTech

8. S. Haslinger, R. Amsüss, C. Koller, C. Hufnagel, N. Lippok, J. Majer, J. Verdu, S. Schneider und J. Schmiedmayer "Electron beam driven alkali metal atom source for loading a magneto-optical trap in a cryogenic environment" Applied Physics B, 102 (2011), 4 , S. 819-823

9. Th. Betz, S. Manz, R. Bücker, T Berrada, C. Koller, G.A. Kazakov, I. Mazets, H.P. Stimming, A. Perrin, Thorsten Schumm, J. Schmiedmayer: "Two-Point Phase Correlations of a One-Dimensional Bosonic Josephson Junction"; Physical Review Letters, 106 (2011), 020407; S. 1 - 4.

10. S. Manz, R. Bücker, Th. Betz, C. Koller, S. Hofferberth, I. Mazets, A. Imambekov, E. Demler, A. Perrin, J. Schmiedmayer, Thorsten Schumm: "Two-point density correlations of quasicondensates in free expansion"; Physical Review A, 81 (2010), S. 031610-1 - 031610-4.

11. R. Bücker, A. Perrin, S. Manz, Th. Betz, C. Koller, T. Plisson, J. Rottmann, Thorsten Schumm, J. Schmiedmayer: "Single-particle-sensitive imaging of freely propagating ultracold atom"; New Journal of Physics, 11 (2009).

12. J. Verdu, H. Zoubi, C. Koller, J. Majer, H. Ritsch, J. Schmiedmayer: "Strong magnetic coupling of an ultracold gas to a superconducting waveguide cavity"; Physical Review Letters, 103 (2009), S. 043603-1 - 043603-4.

13. W. Rohringer, R. Bücker, S. Manz, Th. Betz, C. Koller, M. Göbel, A. Perrin, J. Schmiedmayer, Thorsten Schumm: "Stochastic optimization of a cold atom experiment using a genetic algorithm"; Applied Physics Letters, 93 (2008), 264101; S. 264101-1 - 264101-3.

14. H. Winkler, K.-A. Lorenzer, S. Laumann, J. Custers, A. Prokofiev, and S. Paschen, "Chemical pressure, dilution and disorder in the heavy fermion compounds $Ce_{3-x}La_xPd_{20}Si_6$ (x=1/3, 2/3)", J. Phys.: Condens. Matter **23**, 094208 (2011)

15. R. Pazourek, J. Feist, S. Nagele, E. Persson, B. I. Schneider, L. A. Collins, and J. Burgdörfer, "Universal features in sequential and nonsequential two-photon double ionization of helium", arXiv:1102.1751 (2011), accepted for Phys. Rev. A

16. S. Nagele, R. Pazourek, J. Feist, K. Doblhoff-Dier, C. Lemell, K. Tőkési, J. Burgdörfer, "Time-resolved photoemission by attosecond streaking: extraction of time information", arXiv:1102.1461v1 (2011), accepted for J. Phys. B

17. M. Schultze, M. Fiess, N. Karpowicz, J. Gagnon, M. Korbman, M. Hofstetter, S. Neppl, A. Cavalieri, Y. Komninos, T. Mercouris, R. Pazourek, S. Nagele, J. Feist, J. Burgdörfer, A. Azzeer, R. Ernstorfer, R. Kienberger, U. Kleineberg, E. Goulielmakis, F. Krausz, and V. S. Yakovlev, "Delay in Photoemission", Science **328**, 1658 (2010)

18. M. Kurka, J. Feist, D. Horner, A. Rudenko, Y. Jiang, K. Kühnel, L. Foucar, T. Rescigno, W. McCurdy, R. Pazourek, S. Nagele, M. Schulz, O. Herrwerth, M. Lezius, M. Kling, M. Schöffler, A. Belkacem, S. Düsterer, R. Treusch, B. I. Schneider, L. A. Collins, J. Burgdörfer, C. Schröter, R. Moshammer, and J. Ullrich, "Differential cross sections for nonsequential double ionization of He by 52 eV photons from the Free Electron Laser in Hamburg, FLASH", New Jour. Phys, **12**, 073035 (2010)

19. J. Feist, S. Nagele, R. Pazourek, E. Persson, B. I. Schneider, L. A. Collins, and J. Burgdörfer, "Probing Electron Correlation via Attosecond xuv Pulses in the Two-Photon Double Ionization of Helium", Phys. Rev. Lett. **103**, 063002 (2009)

20. J. Feist, R. Pazourek, S. Nagele, E. Persson, B. I. Schneider, L. A. Collins, and J. Burgdörfer, "Electron correlation in two-photon double ionization of helium from attosecond to XFEL pulses", J. Phys. B **42**, 134014 (2009)

21. J. Feist, S. Nagele, R. Pazourek, E. Persson, B. I. Schneider, L. A. Collins, and J. Burgdörfer, "Nonsequential two-photon double ionization of helium", Phys. Rev. A **77**, 043420 (2008)

22. W. Parz, O. Pfäffli, J. Darmo, M. Austerer, G. Strasser, K. Unterrainer:"statical and dynamical properties of intersubband-gain in mid-infrared quantum cascade lasers";16th International Conference on Electron Dynamics In Semiconductors, Optoelectronics and Nanostructures, Montpellier, Le Corum; 24.08.2009 - 28.08.2009; in: "Book of Abstracts", (2009), S. 280.

23. W. Parz, O. Pfäffli, T. Müller, J. Darmo, M. Austerer, G. Strasser, Gaal, K. Reimann, M. Woerner, L.R. Wilson, J.W. Cockburn, A.B. Krysa, J.S. Roberts, K. Unterrainer:"Intersubband gain induced dispersion and relaxation dynamics in quantum cascade lasers bekow and threshold";The 10th International Conference on Intersubband Transitions in Quantum Wells, Montreal, Cananda; 06.09.2009 - 11.09.2009; in: "Book of Abstracts", (2009), S. 66.

24. W. Parz, O. Pfäffli, T. Müller, J. Darmo, G. Strasser, L.R. Wilson, J.W. Cockburn, A.B. Krysa, J.S. Roberts, K. Unterrainer:"Analysis of sub-picosecond mid-infrared pulse propagation in a quantum cascade laser below and above Ereshold";CLEO/Europe-EQEC 2009, München, Deutschland; 14.06.2009 - 19.06.2009; in: "Book of Abstracts", (2009), ISBN: 978-1-4244-4080-1; Paper-Nr. CB11.4.

25. D. Nicoletti, O. Limaj, P. Calvani, G. Rohringer, A. Toschi, G. Sangiovanni, M. Capone, K. Held, S. Ono, Yoichi Ando, and S. Lupi, Phys. Rev. Lett. **105**, 077002 (2010)

26. A. Toschi, G. Rohringer, A.A. Katanin, and K. Held, "Ab initio calculations with the dynamical vertex approximation", submitted to Annalen der Physik, (2011).

27. L. Shafeek, S. Laumann, A. Prokofiev, and S. Paschen, "Physical properties of the new cage compound $Ce_4Pt_{12}Sn_{25}$", J. Phys.: Conf. Series **200**, 012182 (2010)

28. Y. Suchorski, C. Spiel, D. Vogel, W. Drachsel, R. Schlögl, G. Rupprechter, "Local Reaction Kinetics by Imaging: CO Oxidation on Polycrystalline Platinum", ChemPhysChem (**11**), 3231 (2010).

29. C. Spiel, D. Vogel, Y. Suchorski, W. Drachsel, R. Schlögl, G. Rupprechter, "Catalytic CO Oxidation on Individual (110) Domains of a Polycrystalline Pt Foil: Local Reaction Kinetics by PEEM", Catal. Lett. (2011), in print.

30. D. Vogel, C. Spiel, Y. Suchorski, A. Urich, W. Drachsel, R. Schlögl, G. Rupprechter, "Mapping the Local Reaction Kinetics by PEEM: Catalytic CO Oxidation on Individual Crystalline Domains of a Pt Foil", in preparation.

31. C. Spiel, D. Vogel, Y. Suchorski, W. Drachsel, R. Schlögl, G. Rupprechter:"Catalytic CO Oxidation on Individual (110) Domains of a Polycrystalline Pt Foil: Bistability and Reaction Front Propagation", Proceedings of the 10th International Symposium on Catalysis **1** (2010), ISBN: 978-83-929430-4-4, S. 13 - 20.

32. H. Xu, T. Okino, K. Yamanouchi, S. Roither, X. Xie, D. Kartashov, Li Zhang, A. Baltuska, and M. Kitzler, "Two-Proton Migration in 1,3-Butadiene in Intense Laser Fields", Phys. Chem. Chem. Phys. **12**, 12939 (2010)

33. S. Roither, X. Xie, D. Kartashov, Li Zhang, M. Schöffler, H. Xu, A. Iwasaki, T. Okino, K. Yamanouchi, A. Baltuska, and M. Kitzler, "High energy proton ejection from hydrocarbon molecules driven by highly efficient field ionization", accepted for Phys. Rev. Lett. on Mar 21 2011, in print.

34. Li Zhang, S. Roither, X. H. Xie, D. Kartashov, A. Iwasaki, H. L. Xu, M. Schöffler, G. Reider, R. Dörner, K. Yamanouchi, A. Baltuska, and M. Kitzler,"Momentum Imaging of Three-Body Fragmentation Pathways in Polyatomic Molecules", Proceedings to Ultrafast Phenomena XVII, Oxford University Press, (2010), ISBN: 9780199768370, 952 pages.

35. X. Xie, S. Roither, D. Kartashov, Li Zhang, E. Persson, S. Gräfe, M. Schöffler, M. Lezius, G. Reider, R. Dörner, J. Burgdörfer, A. Baltuska, M. Kitzler,"Driving Electronic Wavepackets by Attosecond Half-Cycle Pulses", Proceedings to Ultrafast Phenomena XVII, Oxford University Press, (2010), ISBN: 9780199768370, 952 pages.

36. S. Roither, X. H. Xie, D. Kartashov, Li Zhang, H. L. Xu, A. Iwasaki, M. Schöffler, G. Reider, R. Dörner, K. Yamanouchi, A. Baltuska, and M. Kitzler,"Coincidence study of Proton Ejection from Polyatomic Molecules in Laser Induced Fragmentation", Proceedings to Ultrafast Phenomena XVII, Oxford University Press, (2010), ISBN: 9780199768370, 952 pages.

Chapter 3

Scientific presentations by DK FunMat students

DK FunMat students have presented their work at various national and international meetings (names of DK FunMat students are underlined):

1. R.G. Deshmukh, U. Schubert: "Meso/microporous strontium titanate for thermoelectric application"; Poster: Junior Scientist Conference 2010, Vienna, Austria; 07.04.2010 - 09.04.2010.

2. R.G. Deshmukh, U. Schubert: "Synthesis of metal nitride@SiO2 nanocomposites from hybrid silica sol-gel precursors"; Poster: Second International Conference on Multifunctional, Hybrid and Nanomaterials, Strasbourg, France; 06.03.2011 - 10.03.2011.

3. V. A. Du and U. Schubert: "Synthesis Of Transition Metal Silyl Complexes And Application For Transition Metal Silicide Nanoparticles"; Poster: 13^{th}Austrian Chemistry Day, Vienna; 24.08.2009 - 27.08.2009.

4. V. A. Du and U. Schubert: "Synthesis of Transition Metal Silyl Complexes and Applications for Transition Metal Silicide Nanoparticles"; Poster: 5^{th} European Silicon Days 2009, Vienna; 20.09.2009 - 22.09.2009.

5. V. A. Du and U. Schubert: "En Route to Transition Metal Silicide Nanoparticles"; Talk: 6^{th} Workshop Inorganic Chemistry in Austria, Johannes Kepler University, Linz; 29.03.2010 - 30.03.2010.

6. V. A. Du and U. Schubert: "Experimental and Computational Studies on the Reactivity of a Single-Source Precursor for Iron Silicide Nanoparticles"; Poster: Junior Scientist Conference 2010, Vienna; 07.04.2010 - 09.04.2010

7. V. A. Du and U. Schubert: "Transition metal silicide nanoparticles derived from single-source precursors"; Poster: 7^{th} International Conference on Inorganic Materials, Bellevue Centre, Biarritz, France; 12.09.2010 - 14.09.2010.

8. D. Fischer, W. Rohringer, D. Heine, T. Raub, S. Loziczki T. Schumm, B. Hessmo and J. Schmiedmayer: "Exploring quantum statistics with an integrated single atom flourescence detector"; Poster: Stockholm Summer School on Quantum Optics and Nanophotonics, Stockholm, Sweden, 21.06.2010 - 25.06.2010.

9. D. Fischer, W. Rohringer, D. Heine, T. Raub, S. Loziczki, T. Schumm, B. Hessmo and J. Schmiedmayer: "Probing quantum gases with an integrated single atom flourescence detector"; Poster: Junior Scientist Conference, Vienna, Austria, 07.04.2010 - 09.04.2010.

10. C. Koller, W. Rohringer, R. Bücker, S. Manz, Th. Betz, M. Göbel, A. Perrin, J. Schmiedmayer, Thorsten Schumm: "RF and MW dressed adiabatic potentials"; Vortrag: Young Atom Opticians Conference, Florence, Italy; 25.03.2008 - 29.03.2008.

11. C. Koller, R. Amsüss, S. Haslinger, Christoph Hufnagel, N. Lippok, C. Nowotny, M. Schramböck, S. Schneider, J. Majer, J. Schmiedmayer: "Towards a solid state - atomic ensemble quantum hybrid system"; Poster: Scala Summer school 2009, Cargese; 17.08.2009 - 29.08.2009.

12. C. Koller, R. Amsüss, S. Haslinger, Christoph Hufnagel, N. Lippok, C. Nowotny, M. Schramböck, S. Schneider, J. Majer, J. Schmiedmayer: "Hybrid Quantum Systems - Integrating solid state and atomic qubits"; Poster: Junior Scientist Conference 2010, TU Wien; 07.04.2010 - 09.04.2010.

13. C. Koller, R. Amsüss, S. Haslinger, Christoph Hufnagel, N. Lippok, C. Nowotny, M. Schramböck, S. Schneider, J. Majer, J. Schmiedmayer: "Hybrid Quantum Systems - Integrating solid state and atomic qubits"; Poster: , FB TRR21 Summerschool Blaubeuren; 03.10.2010 - 05.10.2010.

14. C. Koller, R. Amsüss, S. Haslinger, Christoph Hufnagel, N. Lippok, C. Nowotny, M. Schramböck, S. Schneider, J. Schmiedmayer,J. Majer: "Light effects on High-Q resonators for quantum hybrid systems"; Poster: , DPG Frühjahrstagung; 13.03.2011 - 18.03.2011.

15. K.-A. Lorenzer, H. Winkler, J. Custers, G. Hilscher, M. Kriegisch, A. Prokofiev, and S. Paschen: "Anisotropy effects in the Kondo insulator $CeRu_4Sn_6$"; Poster: Junior Scientist Conference 2010, TU Vienna, Vienna, Austria; 07.04.2010 - 09.04.2010.

16. K.-A. Lorenzer, H. Winkler, J. Custers, A. Prokofiev, and S. Paschen: "Low-temperature resistivity and Hall effect measurements of the Kondo insulator $CeRu_4Sn_6$"; Poster: The New Generation in Strongly Correlated Electron Systems 2010, Lanzarote, Spain; 20.06.2010 - 26.06.2010.

17. R. Pazourek, S. Nagele, J. Feist, and J. Burgdörfer: "Apparent time delays in atomic attosecond streaking"; Talk: Gordon Research Conference on Multiphoton Processes, Tilton, NH, USA; 06.06.2010 - 11.06.2010.

18. R. Pazourek: "Measurement of time delays in atomic photoionization through attosecond streaking"; Talk: ITAMP Seminar, Harvard-Smithonian Center for Astrophysics, Cambridge, MA, USA; 03.06.2010.

19. R. Pazourek, J. Feist, S. Nagele, G. Schoissengeier, E. Persson, B. I. Schneider, L. A. Collins, and J. Burgdörfer: "Two-photon double ionization of helium by chirped attosecond XUV pulses"; Talk: 41th Meeting of the Division for Atomic, Molecular and Optical Physics, DAMOP 2010, Houston, TX, USA; 25.05.2010 - 29.05.2010.

20. R. Pazourek, S. Nagele, J. Feist, and J. Burgdörfer: "Ab inito simulations for streaking of shake-up ionization in helium"; Talk: Annual Meeting of the IMPRS-APS 2010, Carl Friedrich von Siemens Stiftung, München, Germany; 15.12.2010 - 16.12.2010.

21. R. Pazourek, S. Nagele, J. Feist, and J. Burgdörfer: "Streaking of shake-up ionization in helium"; Poster: IMPRS MAP summer workshop 2010, Wildbad Kreuth, Germany; 01.08.2010 - 06.08.2010.

22. R. Pazourek, J. Feist, S. Nagele, E. Persson, B. I. Schneider, L. A. Collins, and J. Burgdörfer: "Ultrafast two-electron dynamics in helium"; Talk: COST WG1 meeting, Han-sur-Lesse, Belgium; 12.04.2010 - 16.04.2010.

23. R. Pazourek, S. Nagele, J. Feist, A. Kaltenbäck, E. Persson, B. I. Schneider, L. A. Collins, and J. Burgdörfer: "Streaking of shake-up ionization in helium"; Poster: Junior Scientist Conference 2010, TU Wien; 07.04.2010 - 09.04.2010.

24. R. Pazourek, J. Feist, S. Nagele, A. Kaltenbäck, E. Persson, B. I. Schneider, L. A. Collins, and J. Burgdörfer: "Streaking of Shake-Up Ionization"; Talk: Workshop "Quantum Dynamic Imaging", Montreal, Canada; 19.10.2009 - 23.10.2009.

25. R. Pazourek, J. Feist, S. Nagele, E. Persson, L. A. Collins, B. I. Schneider, and J. Burgdörfer: "Probing shake-up states in He by laser controlled rescattering of XUV photoelectrons"; Talk: DPG Spring Meeting 2009 - section AMOP, Hamburg, Germany; 02.03.2009 - 06.03.2009.

26. W. Parz, O. Pfäffli, J. Darmo, M. Austerer, G. Strasser, Gaal, K. Reimann, M. Woerner, L.R. Wilson, J.W. Cockburn, A.B. Krysa, J.S. Roberts, K. Unterrainer:"Probing of statical and dynamical intersubband gain properties in quantum cascade lasers";Vortrag: Nanostructures Key Technologies of the 21st Century..., Johannes Kepler Universität Linz, Linz; 11.06.2009 - 12.06.2009

27. W. Parz, O. Pfäffli, J. Darmo, M. Austerer, G. Strasser, K. Unterrainer:"statical and dynamical properties of intersubband-gain in mid-infrared quantum cascade lasers";Vortrag: 16th International Conference on Electron Dynamics In Semiconductors, Optoelectronics and Nanostructures, Montpellier, Le Corum; 24.08.2009 - 28.08.2009

28. W. Parz, O. Pfäffli, T. Müller, J. Darmo, M. Austerer, G. Strasser, Gaal, K. Reimann, M. Woerner, L.R. Wilson, J.W. Cockburn, A.B. Krysa, J.S. Roberts, K. Unterrainer:"Intersubband gain induced dispersion and relaxation dynamics in quantum cascade lasers bekow and threshold";Vortrag: The 10th International Conference on Intersubband Transitions in Quantum Wells, Montreal, Canada; 06.09.2009 - 11.09.2009;

29. W. Parz, O. Pfäffli, T. Müller, J. Darmo, G. Strasser, L.R. Wilson, J.W. Cockburn, A.B. Krysa, J.S. Roberts, K. Unterrainer:"Analysis of sub-picosecond mid-infrared pulse propagation in a quantum cascade

laser below and above Ereshold";Vortrag: CLEO/Europe-EQEC 2009, München, Deutschland; 14.06.2009 - 19.06.2009

30. G. Rohringer: "Critical behavior and phase diagram of the Hubbard model" ; Talk: Realistic Theories of Correlated Electrons in Condensed Matter, Moscow and Volga-River, Russia 01.-08.08.2010.

31. G. Rohringer, A. Toschi and K. Held: "High-temperature optical behavior of Bi-based cuprates"; Talk: Früjahrstagung Deutsche Physikalische Gesellschaft, Regensburg,21.-26.03.2010.

32. G. Rohringer, A. Toschi and K. Held: "Optical spectral weight in cuprates: A DMFT study"; Poster: Junior Scientific Conference, Vienna, 07.-09.04.2010

33. L. Shafeek, S. Laumann, A. Prokofiev, and S. Paschen, " $Ce_4Pt_{12}Sn_{25}$ - A new strongly correlated thermoelectric material?", Poster: The International Conference on Magnetism - ICM 2009, Karlsruhe, Germany; 26.07.2009 - 31.07.2009.

34. L. Shafeek,A. Prokofiev, K. A. Lorenzer, J. Custers, M. Reissner and S. Paschen, " Thermoelectric properties of $Ce_4Pt_{12}Sn_{25}$", Poster: Thermoelectric Winter School Bremen, Germany; 14.02.2010 - 19.02.2010.

35. L. Shafeek,A. Prokofiev, K. A. Lorenzer, and S. Paschen, " Physical properties of the new cage compound $Ce_4Pt_{12}Sn_{25}$", Poster: Junior Scientist Conference Vienna, Austria; 07.04.2010 - 09.04.2010.

36. D. Vogel, C. Spiel, Y. Suchorski, W. Drachsel, R. Schlögl, G. Rupprechter: "Locally Resolved Study of CO Oxidation on Polycrystalline Pd: Reaction Kinetics and Surface Morphology"; Vortrag: 11th Palladium Day, (organized by Fritz Haber-Institut Berlin, TU Wien Institut für Materialchemie, Uni Innsbruck Physikalische Chemie), Berlin, Germany; 21.03.2011 - 22.03.2011.

37. D. Vogel, C. Spiel, Y. Suchorski, W. Drachsel, R. Schlögl, G. Rupprechter: "CO Oxidation on Individual Grains of Polycrystalline Pt and Pd: Locally Resolved Reaction Kinetics"; Vortrag: 10th Palladium Day, (organized by Fritz Haber-Institut Berlin, TU Wien Institut für Materialchemie, Uni Innsbruck Physikalische Chemie), Berlin, Germany; 18.05.2010 - 19.05.2010.

38. D. Vogel, C. Spiel, Y. Suchorski, W. Drachsel, R. Schlögl, G. Rupprechter: "Locally Resolved Kinetics of Catalytic CO Oxidation on Polycrystalline Platinum", Poster: Junior Scientist Conference 2010, Vienna, 07.04.2010 - 09.04.2010.

39. D. Vogel, C. Spiel, Y. Suchorski, W. Drachsel, R. Schlögl, G. Rupprechter: "Locally Resolved Kinetics of Catalytic CO Oxidation on Polycrystalline Platinum"; Poster: Frühjahrstagung der Sektion Kondensierte Materie der Deutschen Physikalischen Gesellschaft 2010, Regensburg, Germany, 22.03.2010 - 26.03.2010.

40. D. Vogel, C. Spiel, Y. Suchorski, W. Drachsel, R. Schlögl, G. Rupprechter: "PEEM Microscopy of Catalytic CO Oxidation on Polycrystalline Pt"; Vortrag: 9th Palladium Day (organized by Fritz Haber-Institut Berlin, TU Wien Institut für Materialchemie, Uni Innsbruck Physikalische Chemie), Wien, Austria; 19.10.2009 - 20.10.2009.

41. Li Zhang, S. Roither, X. Xie, D. Kartashov, A. Iwasaki, H.L. Xu, M. Schöffler, G. Reider, R. Dörner, K. Yamanouchi, A. Baltuska, M. Kitzler: "Momentum Imaging of Three-Body Fragmentation Pathways in Polyatomic Molecules"; Poster: 17th International Conference on Ultrafast Phenomena, Colorada, USA; 18.07.2010 - 23.07.2010.

42. Li Zhang, S. Roither, X. Xie, D. Kartashov, A. Iwasaki, H.L. Xu, S. Gräfe, M. Schöffler, G. Reider, R. Dörner, K. Yamanouchi, A. Baltuska, and M. Kitzler: "Coincidence imaging of fragmentation pathways in polyatomic molecules"; Poster: 10th European Conference on Atoms Molecules and Photons (ECAMP 10), Salamanca, Spain; 04.07.2010 - 09.07.2010.

43. Li Zhang, X. Xie, S. Roither, D. Kartashov, E. Persson, S. Gräfe, M. Schöffler, M. Lezius, R. Dörner, J. Burgdörfer, A. Baltuska, and M. Kitzler: "Driving electronic Wave Packets by Attosecond Half-Cycle Pulses"; Talk: CCAST Workshop on "Strong Field Laser Physics" 2010, Shanghai, PRC; 07.04.2010 - 09.04.2010.

44. Li Zhang, S. Roither, X. Xie, D. Kartashov, S. Gräfe, H.L. Xu, A. Iwasaki, T. Okino, K. Nakai, M. Schöffler, K. Yamanouchi, A. Baltuska, and M. Kitzler: "Momentum Imaging Of Three-Body Fragmen-

tation Pathways In Polyatomic Molecules"; Poster: Junior Scientist Conference 10 (JSC 10), Vienna, Austria; 07.04.2010 - 09.04.2010.

45. Li Zhang, S. Roither, D. Kartashov, M. Schöffler, X. Xie, M. Lezius, R. Dörner, A. Baltuska, and M. Kitzler, "Many Particle Fragmentation Dynamics of Polyatomic Hydrocarbon Molecules"; Poster: CLEO Pacific Rim 2009, Shanghai, China, 30.08.2009 - 03.09.2009.

Chapter 4

The DK FunMat Seminar Series

Each DK FunMat student presented progress in her/his work once per semester in the DK FunMat Seminar Series:

1. R.G. Deshmukh, 29.01.2010,"Thermoelectrics based on SrTiO3".
2. R.G. Deshmukh, 25.05.2010,"Thermoelectrics based on mesoporous strontium titanate".
3. R.G. Deshmukh, 25.01.2011,"Synthesis of metal nitride nanoparticles on silica matrix".
4. V. A. Du, 13.11.2009, "From Transition Metal Silyl Complexes to Transition Metal Silicide Nanoparticle".
5. V. A. Du, 30.04.2010, "Transition Metal Silicide Nanoparticles derived from Single-Source Precursors".
6. V. A. Du, 25.01.2011, "Metal Silicide Nanoparticles-Synthesis and Characterization".
7. D. Fischer, 01.29.2010, "An introduction to the micro-optics experiment".
8. D. Fischer, 23.04.2010, "Producing and probing degenerate quantum gases in the micro-optics setup".

9. D. Fischer, 14.12.2010, “Correlations in photonic and atomic ensembles”.

10. C. Koller, 13.11.2009, “From RF dressed potentials to a solid state atomic ensemble hybrid system”.

11. C. Koller, 29.06.2010, “Cavity Quantum Electrodynamics with Ensembles”.

12. C. Koller, 09.11.2010, “Strong Coupling of a Microwave Resonator to an ensemble of Nitrogen Vacancies in Diamond”.

13. K.-A. Lorenzer, 11.12.2009, “Itinerant electron metamagnetism”.

14. K.-A. Lorenzer, 29.06.2010, “Introduction to Muon Spin Relaxation”.

15. K.-A. Lorenzer, 14.12.2010, “Transport properties of the heavy fermion compound $Ce_3Pd_{20}Si_6$”.

16. R. Pazourek, 09.11.2010, “Measurement of time delays in atomic photoionization through attosecond streaking”.

17. R. Pazourek, 23.04.2010, “Ultrafast two-electron dynamics in helium”.

18. R. Pazourek, 13.11.2009, “Electronic correlation effects and attosecond dynamics in helium”.

19. G. Rohringer, 11.12.2009, “Green function methods and DMFT”

20. G. Rohringer, 25.05.2010, “Theoretical calculations in many body systems”

21. G. Rohringer, 29.01.2010, “Criticality in strongly correlated electron systems”

22. L. Shafeek, 26.05.2009, “$Ce_4Pt_{12}Sn_{25}$ - A new strongly correlated thermoelectric material”.

23. L. Shafeek, 11.12.2009, “Physical properties of new cage compound $Ce_4Pt_{12}Sn_{25}$ and Synthesis of $FeSb_2$ nanowires”.

24. L. Shafeek, 29.04.2010, “Nanostructured Thermoelectrics”.

25. L. Shafeek, 14.12.2010, "Synthesis Techniques of $FeSb_2$ nanowires".

26. D. Vogel, 09.11.2010, "Influence of the Surface Morphology on Local Reaction Kinetics in Catalytic CO Oxidation on Pt and Pd Foil".

27. D. Vogel, 25.05.2010, "CO Oxidation on Individual Grains of Polycrystalline Pt and Pd: Locally Resolved Reaction Kinetics".

28. D. Vogel, 11.12.2009, "*In Situ* Visualization of a Catalytic Reaction: CO Oxidation on Polycrystalline Pt".

29. L. Zhang, 25.01.2011, "Coincidence imaging of fragmentation pathways in polyatomic molecules".

30. L. Zhang, 29.06.2010, "Highly energetic protons from polyatomic hydrocarbon molecules in strong laser fields".

31. L. Zhang, 29.01.2010, "Driving electronic wave packets by attosecond half-cycle pulses".

Chapter 5

ECTS credits for DK FunMat Formal Training

The following ECTS credits were awarded for lectures of the DK FunMat Formal Training Curriculum:

1. R.G. Deshmukh, 138.068 Lecture Series Introduction to Functional Matter, 2011, 3 ECTS.
2. V. A. Du, 165.088 Chemie der Nanomaterialien, 09.07.2008, 3 ECTS.
3. V. A. Du, 138.068 Lecture Series Introduction to Functional Matter, 22.01.2010, 3 ECTS.
4. V. A. Du, 165.103 Kinetik und Katalyse, 08.07.2010, 3 ECTS.
5. V. A. Du, 165.092 Anorganische Materialchemie, 20.12.2010, 4.5 ECTS.
6. D. Fischer, 138.068 Lecture Series Introduction to Functional Matter, 22.01.2010, 3 ECTS.
7. D. Fischer, 138.061 Quantum Computing and Quantum Dots, 22.01.2010, 3 ECTS.
8. C. Koller, 138.068 Lecture Series Introduction to Functional Matter, 22.01.2010, 3 ECTS.
9. C. Koller, 141.246 Quantum Information Physics, 30.06.2008, 3 ECTS.

10. C. Koller, 141.231 Macroscopic Quantum Systems, 27.06.2007,3 ECTS.

11. K.-A. Lorenzer, 138.068 Lecture Series Introduction to Functional Matter, 22.01.2010, 3 ECTS.

12. R. Pazourek, 138.068 Lecture Series Introduction to Functional Matter, 28.01.2011, 3 ECTS.

13. R. Pazourek, 387.044 Ultrafast Lasers, 17.03.2001, 3 ECTS.

14. G. Rohringer, 138.068 Lecture Series Introduction to Functional Matter, 22.01.2010, 3 ECTS.2010.

15. G. Rohringer, 138.068 Quantenfeldtheorie für Vielteilchensysteme, 15.03.2010, 3 ECTS.2010.

16. L. Shafeek, 138.068 Lecture Series Introduction to Functional Matter, 22.01.2010, 3 ECTS.

17. L. Shafeek, 138.056 Functional Materials, 21.06.2010, 3 ECTS.

18. L. Shafeek, 165.088 Chemie der Nanomaterialien, 30.06.2010, 3 ECTS.

19. D. Vogel, 165.103 Kinetik und Katalyse, 06.08.2010, 3 ECTS.

20. D. Vogel, 138.068 Lecture Series Introduction to Functional Matter, 22.01.2010, 3 ECTS.

21. L. Zhang, 387.044 Ultrafast Lasers, 11.06.2009, 3 ECTS.

Chapter 6

Extended stays at external laboratories

DK FunMat students have spent extended durations at an external laboratory:

1. V. A. Du, Shell Technology Centre, Amsterdam, Netherlands, 15.11.2010-17.12.2010.

2. L. Zhang, Division of Physical Chemistry, Department of Chemistry, School of Science, The University of Tokyo, Tokyo, Japan, 18.10.2010-22.10.2010.

3. L. Zhang, Division of Physical Chemistry, Department of Chemistry, School of Science, The University of Tokyo, Tokyo, Japan, 30.11.2009-22.12.2009.