Report 2005–2007

Nils Blümer

August 17, 2007

Contents

`http://komet337.physik.uni-mainz.de/Bluemer/Eval/report_evaluation_NB.pdf`

Personalia

Name	Juniorprofessor Dr. Nils Blümer
Date and place of birth	31.08.1970 in München
Private address	Weisenauer Gasse 20 65474 Bischofsheim
Office address	Institut für Physik Johannes-Gutenberg-Universität Mainz Staudingerweg 7 55128 Mainz

Scientific career

1991 - 1996	Studies of Physics and Mathematics at the RWTH Aachen
7/1996	Diploma in physics
1996 - 1997	Graduate student (as Fulbright fellow) at the University of Illinois at Urbana-Champaign (UIUC)
1997	Teaching/research assistant at UIUC (for Prof. R. Martin / Prof. D. Ceperley)
2000	Master of Science (UIUC)
1997 - 2000	Graduate student with Prof. Dr. D. Vollhardt at the University of Augsburg
1999	Research stay with Prof. Mark Jarrell, University of Cincinnati
12/2002	Dr. rer. nat. (*summa cum laude* in Augsburg), thesis: *Mott-Hubbard Metal-Insulator Transition and Optical Conductivity in High Dimensions*
2001 - 2005	Research assistant (since 2003 research associate, C1) with Prof. Dr. P. van Dongen at the University of Mainz
11/2004	Offer of assistant professorship (Juniorprofessur) for Theoretical Physics at the University of Frankfurt/Main (declined)
since 2/2005	Assistant professor (Juniorprofessor) for Theoretical Solid State Physics at the University of Mainz

Fellowships and awards

1996 - 1997	Fulbright scholarship
1996	*Best student poster* at the Midwestern Solid State Theory Conference (UIUC)

1 Research

1.1 Publications and preprints

[1] **N. Blümer** and E. Kalinowski
Mott insulator: Tenth-order perturbation theory extended to infinite order using a quantum Monte Carlo scheme
Phys. Rev. B **71**, 195102 (2005).

[2] **N. Blümer** and E. Kalinowski
Ground state of the frustrated Hubbard model within DMFT: energetics of Mott insulator and metal from ePT and QMC
Physica B **359-361**, 648 (2005).

[3] M. Kollar, M. Eckstein, K. Byczuk, **N. Blümer**, P. van Dongen, M. H. Radke de Cuba, W. Metzner, D. Tanaskovic, V. Dobrosavljevic, G. Kotliar, and D. Vollhardt
Green functions for nearest- and next-nearest-neighbor hopping on the Bethe lattice
Ann. Phys. (Leipzig) **14**, 642 (2005).

[4] C. Knecht, **N. Blümer**, and P. G. J. van Dongen
Orbital-selective Mott transitions in the anisotropic two-band Hubbard model at finite temperatures
Phys. Rev. B **72**, 081103(R) (2005).

[5] C. Knecht, **N. Blümer**, and P. G. J. van Dongen
Reply to "Comment on 'Orbital-selective Mott transitions in the anisotropic two-band Hubbard model at finite temperatures'"
cond-mat/0506450 (not published, since comment was not accepted by Phys. Rev. B).

[6] P. G. J. van Dongen, C. Knecht, and **N. Blümer**
Orbital-selective Mott transitions in the 2-band Jz-model: a high-precision quantum Monte Carlo study
phys. stat. sol. (b) **243**, 116 (2006).

[7] K. Held, I.A. Nekrasov, G. Keller, V. Eyert, **N. Blümer**, A.K. McMahan, R.T. Scalettar, Th. Pruschke, V.I. Anisimov, and D. Vollhardt
Realistic investigations of correlated electron systems with LDA+DMFT
phys. stat. sol. (b) **243**, 2599 (2006).

[8] **N. Blümer**, C. Knecht, K. Požgajčić, and P. G. J. van Dongen
Orbital-selective Mott transitions in two-band Hubbard models
J. Magn. Magn. Mater. **310**, 922 (2007) .

[9] P. G. J. van Dongen, C. Knecht, and **N. Blümer**
Magnetic phase diagram of the anisotropic multi-band Hubbard model
phys. stat. sol. (b) **244**, 2331 (2007).

[10] **N. Blümer**
Efficiency of quantum Monte Carlo impurity solvers for dynamical mean-field theory
submitted to Phys. Rev. B (with referees); arXiv:0708.1749v1.

For updates, see: `http://komet337.physik.uni-mainz.de/Bluemer/publications`

1.2 Scientific talks

26.02.05 *High-precision DMFT algorithms for double perovskite models*
Symposium der DFG-Forschergruppe 559, Mainz

30.05.05 *Quantum Monte Carlo Studies of Mott Metal-Insulator Transitions within Dynamical Mean-field Theory*, Bewerbungsvortrag (NF Dederichs), IFF Jülich

28.06.05 *Dynamical mean-field theory of Mott transitions and Mott insulators*
Theorieseminar, Univ. Kaiserslautern

28.07.05 *Orbital-selective Mott transitions in the anisotropic 2-band Hubbard model*
NEDO meeting Mainz

01.08.05 *Orbital-selective Mott transitions in the anisotropic two-band Hubbard model at finite temperatures*, Miniconference on Dynamical Mean-Field Theory for Correlated Electrons: Applications to Real Materials, Extensions and Perspectives, Trieste

30.03.06 *Orbital-selective Mott transitions in Hubbard models with orbital-dependent hopping*
DPG Frühjahrstagung Dresden

23.08.06 *Orbital-selective Mott transitions in two-band Hubbard models*
International Conference on Magnetism (ICM), Kyoto

16.02.07 *Efficiency of QMC DMFT solvers*
Miniworkshop Mainz-Marburg, Marburg

02.03.07 *Orbital-selective Mott transitions*
Korrelationstage 2007, Dresden

26.03.07 *Nature and order of orbital-selective Mott transitions*
DPG Frühjahrstagung Regensburg

19.04.07 *Theory of materials with high spin polarization*
Begutachtung der DFG-Forschergruppe 559, Mainz

08.06.07 *Quantum Monte Carlo simulations of strongly correlated electron systems within dynamical mean-field theory*, EPS Computational Physics Group meeting, Mainz

05.07.07 *Critical exponents in strongly correlated electron systems*
Institutstreff 2007, Institut für Physik, Universität Mainz

13.07.07 *Quantum Monte Carlo Simulations within Dynamical Mean-Field Theory*
Theoretisch-Physikalisches Seminar, Leibniz Universität Hannover

21.09.07 *Quantum Monte Carlo Simulations within Dynamical Mean-Field Theory*
MATCOR School "Theory of the Electronic Structure of Materials", Königsfeld

1.3 Conference posters

28.02.05 *Low-temperature properties of the half-filled frustrated Hubbard model in high dimensions*, Korrelationstage 2005, Dresden

01.10.05 *Low-temperature properties of the half-filled frustrated Hubbard model in high dimensions*, Concepts in Electron Correlation, Hvar

Further information: `http://komet337.physik.uni-mainz.de/Bluemer/presentations`

1.4 Organization of scientific meetings

No organization of meetings. However, chairing of the session *TT 13 Correlated Electrons: Metal Insulator Transition 1* at the DPG spring meeting on 28.03.2006.

1.5 Research projects

Within the research area of Solid State Theory, my research interests focus on the theory of strongly correlated electron systems, in particular within the framework of the Dynamical Mean-field Theory (DMFT). The DMFT maps the complicated many-body problem of interacting electrons in a solid, as formulated in Hubbard-type models, onto a single-impurity Anderson model (SIAM) which is self-consistently embedded in a dynamic bath; this mapping becomes exact in the limit of infinite coordination number. In contrast to the analogous Weiss mean-field theory for spin models, the DMFT retains local dynamical correlations, which are essential for strong-correlation phenomena such as magnetism, metal-insulator transitions, orbital order, and high-temperature superconductivity. Within the last decade, the DMFT has extended its impact beyond model studies; it is now considered an essential ingredient also to realistic band-structure calculations of correlated materials, e.g., in the LDA+DMFT scheme [7]. Important recent methodological developments in the DMFT context include cluster extensions (DCA, CDMFT), generalizations such as Potthoff's self-energy functional theory (SFT), and improved numerical SIAM solvers, based, e.g., on quantum Monte Carlo (QMC) techniques.
In my work, methodological progress and improvement of the physical understanding are typically strongly intertwined, but may involve different time scales. In the following, I will first list projects defined by their physical focus and then turn to more methodological aspects.

Metal-insulator transitions and single-band Hubbard model The study of Mott metal-insulator transitions (MITs) has a long history in solid state physics. In fact, correlated electron systems may even be defined by the appearance of or proximity to some Mott transition, i.e., situations, in which conventional band-structure methods break down. It was clear from early on that the half-filled single-band Hubbard model contains the necessary ingredients for an MIT. However, it was only established within the last decade that and how the MIT actually occurs (within the DMFT). Even today and even for the simplest 1-band case, many questions, in particular the properties of partially frustrated systems, are still open. On the other hand, a full understanding both of the phenomenon MIT and of the fundamental models is desirable as a basis for controlled studies of more complex models and phenomena (such as OSMTs), as well as for hybrid band-structure calculations using LDA+DMFT.
My recent contributions in this context include a novel semi-analytic extension of perturbation theory to infinite order, controlled by comparisons with QMC [1] and, more generally, results of extreme precision, in particular for energetics [2, 10]. We have also formulated the correct self-consistency equations for certain frustrated lattices [3]. In the near future, I plan to publish a study which combines techniques developed in my thesis with new high-precision QMC results [10] for constructing the MIT phase diagram with unprecedented accuracy. Depending on availability of computer time, I (or a student) might also use a very recent advance in our QMC algorithm for solving the problem of partial frustration.

Orbital-selective Mott transitions (OSMTs) Until recently, Mott transitions were assumed (and found) to occur for all valence electrons at the same phase point, even in multi-band

cases. This changed a few years ago, when experiments on $Ca_{2-x}Sr_xRuO_4$ pointed to the possibility of a sequence of "orbital-selective Mott transitions (OSMTs)", where electrons in some orbitals localize at some phase point (e.g., for some interaction or pressure), while the others remain itinerant up to another phase point (e.g., at stronger interaction or lower pressure).
We could show using QMC calculations that – contrary to earlier claims in the literature – OSMTs occur in 2-band Hubbard models with orbital-dependent hopping amplitudes also in the generic case of anisotropic Hund rule couplings [4, 5, 6]. As in the single-band MIT case, the occurrence of OSMT requires strong frustration [9]. In order to clarify the nature of the wide-band transition, we have introduced a generalized model which interpolates between the previously studied models and the well-understood case of uncoupled orbitals [8]. Our conjecture of a new quantum-critical point [8] has been taken up by other groups very recently. I will publish the full results of my collaboration with K. Požgajčić shortly, establishing a first-order wide-band transition on the basis of both self-energy functional theory (SFT) and QMC results. In the future, OSMT related problems will preferably be treated in the quantum gas context.

Theory of new materials with high spin polarization Magnetic materials have been of practical interest since ancient times, both for generating and for detecting magnetic fields. A primary focus today is on "spintronics" (spin-based electronics) applications which include, e.g., read heads for computer hard disks based on giant magnetoresistive or spin valve effects. In order to optimize and further miniaturize such devices, materials are sought with high (ideally full) spin polarization of the valence electrons and high Curie temperatures. The DFG research unit FG 559 participates in this quest with focus on two material classes: Heusler alloys and double perovskite oxides.
Our project initially (since 2004) concentrated on many-body theory for double perovskite models and on extensions of our QMC code; it was assumed that the band structure input needed for LDA+DMFT studies would be contributed by our collaborators. However, in 2006, we decided to build up the competences for "ab initio" calculations using advanced band structure methods within our group. At the same time, we found it necessary to initiate calculations also for Heusler alloys – according to the shifted focus of the research unit. These investments quickly paid off – however, the "downfolded" Heusler band structures appeared too complex to be treated with QMC; various alternatives have been tested. Within the last few months, we have also obtained first QMC spectra for double perovskites. Publishable results are expected on a short time scale. The project will continue at least until 2009, when E. Jakobi is expected to finish his PhD thesis (supported by MATCOR).

Ultracold quantum gases on optical lattices The project "Flavour-selective Mott transitions of ultracold quantum gases on optical lattices", part of the SFB/TR 49 "Condensed Matter Systems with Variable Many-Body Interactions" (cf. section 1.7), aims at exploring analogies to orbital-selective Mott transitions (OSMTs) in the context of ultracold quantum gases. Main focus is the development and evaluation of generalized multi-band Hubbard models for flavor-mixes of ultracold fermions on optical lattices which will be prepared in I. Bloch's project in the TR; here, the different flavors can be realized as different atomic species (in particular: ^{40}K and ^{6}Li), different hyperfine states, and/or different Bloch states (populated by Raman excitation). Since for all of these cases the hopping amplitudes differ by flavor either generically or can be made different by design, a major ingredient to OSMTs is intrinsic to these mixtures; in addition, the interactions can be varied as well. While a complete analogy to the OSMT case would require 4 flavors (pairwise equivalent), interesting new physics can already be expected

starting in the 2-flavor case. Using dynamical mean-field theory (DMFT) in connection primarily with quantum Monte Carlo (QMC) simulations, we will compute phase diagrams and search for signatures accessible to quantum gas experiments as, e.g., (quasi)momentum distributions, magnetic order, correlation functions, and excitation spectra. Both the systems and the observables will be selected in close correspondence to the experiments of I. Bloch's project.
Immediately after the official start of the TR in 07/2007, the PhD position funded by the DFG has been advertised. The selection of candidates is in progress. Independently of this recruiting process, I intend to initiate first QMC calculations for this project in 09/2007; already in 08/2007, a summer school in Trieste will offer excellent possibilities for discussions with other TR project leaders (I. Bloch, W. Hofstetter).

Quantum Monte Carlo algorithms Primary tool for our studies of correlated fermion systems is an advanced implementation of the Hirsch-Fye QMC algorithm as DMFT solver, which supplements the QMC data (with discretization $\Delta\tau$ of the imaginary time) with a high-frequency expansion of the self-energy. In combination with careful extrapolations $\Delta\tau \to 0$, this method allows for very high precision [1, 2] which proved essential, e.g., in detecting the wide-band transition in a two-band model [4]. Recently, I have demonstrated that the method is competitive with new continuous-time QMC solvers [10] (for which much higher efficiency had been claimed).
Within the last few weeks, I have obtained numerically exact imaginary-time Green functions at (ultra-low) temperatures widely considered out of reach for Hirsch-Fye QMC. The publication, planned for the immediate future, might also include the first QMC spectra without discretization error (using a newly devised technique which is not yet fully tested). In the course of these studies, I have also resolved a problem that impacted the applicability of our code to doped systems; this resolution will likely boost our LDA+DMFT activities.
Plans for the next few years include tests of continuous-time methods, of new decoupling methods for spin-flip Hund rule terms, and the generalization of our code to cluster extensions of the DMFT. We might also get involved in the ALPS project (Algorithms and Libraries for Physics Simulations).

Advanced band structure methods Since summer 2006, E. Jacobi is using band structure codes based on density functional theory as part of his PhD thesis: beyond the widely used Stuttgart TB-LMTO program, this includes the more advanced "downfolding" technique for obtaining effective low-energy Hamiltonians, as implemented in the Stuttgart NMTO code. At present, these methods are only applied in the context of the materials studied by the FG 559. However, the methodological experience will almost certainly lead to further applications, e.g., making contact to material-related projects in the SFB/TR 49.

Generalization of self-energy functional theory The self-energy functional theory, conceptionally a generalization of the DMFT, can also be used as an approximation to the DMFT: the dynamical impurity approximation (DIA). The resulting impurity problem with a finite (small) number of attached bath sites is usually solved with exact diagonalization; the DMFT would be recovered for an infinite number of bath sites.
With funding by the Forschungsfonds 2005 of the university (cf. section 1.11), K. Požgajčić has generalized his implementation of this approach to multi-band Hubbard models; test case was the two-band model studied in the context of orbital-selective Mott transitions. After rapid initial progress with very interesting results for the order of both transitions (obtained in 2005),

I found some issues (by detailed comparison with QMC data), calling their reliability into question. As an intermediate step, we could shed light on the non-Fermi-liquid properties of the orbital-selective phase [8]. However, the order of the wide-band transition could only be resolved in late 2006, after the implementation of new measurement procedures; these results will be published as soon as possible. At the moment, there are no specific plans for a continuation or extension of this project; on the other hand, methods complementary to QMC will certainly continue to play an important role in our work.

1.6 Long-term research stays and guests

So far, I have not left the institute for longer periods of time. I have invited guests as the main organizer of the theory seminar of the DFG research unit 559 in Mainz and had extended discussions with many speakers of the KOMET 337 group seminar (organized by P. van Dongen) and of the general theory seminar in Mainz.

1.7 Third party funding and collaborative initiatives

DFG research unit FG 559 "New materials with high spin polarization" (Mainz – Kaiserslautern) Project "Microscopic theory of double perovskites: LDA+DMFT evaluated by QMC" (jointly with Prof. van Dongen) funded by the DFG (2004–2007) within the FG 559: 1 PhD student position (3/4 BAT IIa), cluster compute nodes, travel etc. (total funds: about 150000 EUR). The proposed extension project "Microscopic theory of half-metallic Heusler and double perovskite materials" was not awarded grants for the second funding period of the research unit.

DFG transregional collaborative research center SFB/TR 49 "Condensed Matter Systems with Variable Many-Body Interactions" (Frankfurt – Kaiserslautern – Mainz) Project "Flavour-selective Mott transitions of ultracold quantum gases on optical lattices" funded by the DFG (2007-2011) within the SFB/TR 49: 1 PhD student position (3/4 BAT IIa), cluster compute nodes, travel etc. (total funds exceeding 200000 EUR); further funding possible through associated graduate school.

State graduate school of excellence "Strongly Correlated Quantum Systems: Experiments and Simulation on Molecules, Ultra-cold Quantum Gases, and Materials with Strong Electronic Correlations (MATCOR)" Member of the faculty of the graduate school of excellence MATCOR (speaker: Prof. Felser), established in the state-wide competition (within Rheinland-Pfalz) in 2005. Starting in 10/2007, one of our PhD students (supervised together with Prof. van Dongen) will be fully funded by MATCOR; cf. section 1.9.

Proposed federal school of excellence "Materials science in Mainz (MAINZ)" Inclusion as an associated applicant of the proposed graduate school MAINZ in both stages (2006 and 2007) of the federal competition with participation in workshops (18.02. and 04.03.2006) and text contributions. The initiative (speaker: Prof. Felser) passed a first selection step on 12.01.2007; the final decision is due in 10/2007.

Proposed center for computer aided research methods in natural sciences (Mainz) The preliminary proposal (06/2006) for the foundation of a new (state) research center at the university of Mainz (analogous to the material research center MWFZ) names me as one of 25 applicants; minor contributions to the text and participation in a meeting on 07.04.2006. A first evaluation of the proposal has been positive; however, volume and time frame of funding (for individual projects and structural measures) is still unclear.

Proposed state cluster of excellence "Structure and dynamics of inhomogeneous matter: simulation and experiment" (Mainz) Participation in the state-wide competition (in first half of 2005) for funding of about 3 mio EUR as one of 38 named "key researchers" in this initiative lead by Prof. Binder. This proposal included requested funding of 30000 EUR/year for a PhD position (jointly with Prof. van Dongen) and 50000 EUR as individual one-time start-up funds. However, the initiative was unsuccessful.

Proposed state cluster of excellence "Nano-Bio-Opto-Magneto (O^4)" (Kaiserslautern – Mainz) Participation in the state-wide competition (in first half of 2005) for funding of about 3 mio EUR as one of 28 applicants in this initiative lead by Profs. Aeschlimann, Hillebrands, Oesterschulze, Ziegler (all Kaiserslautern) and Felser (Mainz) which was, ultimately, unsuccessful.

Planned DFG priority programme on computer simulation methods During the Korrelationstage (26.02.-02.03.2007), I have participated in a brainstorming session towards a DFG priority programme on numerical methods for quantum systems, to be lead by Prof. R. Noack (Marburg). I am confident that I will be invited to join the proposal if/when this initiative proceeds.

Planned DFG research unit "Nonequilibrium in strongly correlated systems" (Frankfurt – Mainz – Kaiserslautern) On 28.10.2005, I have attended a meeting in Frankfurt exploring the possibilities for a purely theoretical research unit on strongly correlated systems. However, I concluded that due to lack of experience with nonequilibrium problems (favored as a focus of the initiative by most of the other participants) I could not formulate a promising project in this context and immediately left the initiative.

1.8 Peer review

I am regular referee (with 5 or more review requests per year each) for the journals

- Physical Review Letters
- Physical Review B

and have received review requests from the journals

- Physical Review E
- European Physical Journal B
- Journal of Physics: Condensed Matter.

1.9 Supervised PhD theses

Carsten Knecht (2002–2006): *Numerical and analytical approaches to strongly correlated electron systems*. Partial supervision (main supervisor: P. van Dongen); student was funded by DFG under Bl775/1. 4 publications [4, 6, 8, 9], 1 preprint [5], several talks in Germany and Japan, numerous posters.

Eberhard Jakobi (since 2006): *Theory of materials with high spin polarization*. Supervision jointly with P. van Dongen; student is currently funded by DFG under Bl775/1 and will be funded by the MATCOR graduate school of excellence (starting 10/2007). Several posters.

1.10 Scientific plans 2007–2010

The intended directions of my research within the next few years have already been discussed in section 1.5. Clearly, the SFB/TR project will have quite high priority; due to my limited experience with ultracold quantum gases, it will also require further significant investments. In fact, I might supplement the DFG funded PhD student by a second student or (for a limited time) by a post doc. Materials with high spin polarization will remain an important topic, with close supervision of the associated PhD student, E. Jakobi. The whole group will participate in methodological development, primarily QMC related. However, I will probably continue to address methodological issues separately from the main physical topics, working alone, with outside collaborators, or with a diploma student.
In each of the 5 last semesters, I have prepared new lectures (and problem sets as well as example codes), which required very significant portions of my time. Already in the next 2 semesters, the needed effort will be reduced when I repeat the sequence of my last two lectures. Even with occasional additions to my portfolio of lectures, I expect to have more time for research in the future. At the same time, my lectures (and seminar offers) appear to attract excellent students; several of these might become candidates for diploma theses.
I also anticipate much less involvement with new collaborative initiatives (cf. section 1.7) for the remainder of my time in Mainz. However, I will probably formulate one or more individual DFG grant proposals. At the same time, I will be open for informal outside collaborations.

1.11 Prizes and Awards

I have been awarded 24500 EUR from the research fund 2005 (of the Gutenberg University Mainz) for the project *Generalization of self-energy functional theory for double perovskite models* and 25000 EUR from the research fund 2007 for the project *Orbital selective Mott transitions in ultracold quantum gases on optical lattices*.

1.12 Further information

As one of 6 candidates for a permanent professorship (at the RWTH Aachen), I have been invited to the Forschungszentrum Jülich for a talk and for discussions with several directors of the IFF on May 30, 2005; to my knowledge, this position is still open. This was the most successful of 4 applications for professorships (all W2) so far; I plan for a higher application intensity in the near future.

2 Teaching

2.1 Courses and seminars

Undergraduate level

"Proseminar zur Physik I/II" (summer 2006, jointly with Priv.-Doz. Dr. K. Wendt)
New kind of seminar for first-year students with broad range of topics – 11 participants.

"Ergänzungkurs für Physiker zum Grundkurs II" (summer 2006)
Lecture on advanced topics in physics and on mathematical foundations for students majoring in physics and mathematics – typically 20–30 participants.

"Ergänzungkurs für Physiker zum Grundkurs I" (winter 2005/2006)
Lecture on advanced topics in physics and on mathematical foundations for students majoring in physics and mathematics – number of students decayed from about 100 to about 40.

Graduate and postgraduate level

"Moderne numerische Methoden der Festkörperphysik" (summer 2007)
Lecture on modern numerical methods of solid state physics (Monte Carlo methods for the Ising model, full and partial exact diagonalization as well as world-line quantum Monte Carlo methods for the quantum Heisenberg model; outlook on dynamical mean-field theory) with many programming/application exercises – 3–5 participants.

"Computer simulations in statistical physics" (winter 2006/2007, in English language, jointly with Prof. Dr. W. Paul)
Lecture with focus on Monte Carlo and molecular dynamics simulations of classical systems; also covered: dissipative particle dynamics and path integral Monte Carlo simulations of quantum systems in the continuum – 5–7 students, mostly at PhD level.

"Theory of correlated electron systems" (summer 2005, in English language)
Lecture both on conventional band structure theory (density functional theory in local density approximation) and on many-body approaches as a foundation for the hybrid LDA+DMFT method – 3 students (all from Spain).

2.2 Examinations

05.05.2006	PhD exam Carsten Knecht (minutes)
05.04.2007	Graduation exam Andreas Müller (examiner)
10/2007	Graduation exam Alexander Baade (examiner, planned)

Also minutes (Beisitz) in many graduation exams: intermediate exams (Vorprüfung Diplom) on 23.03.2005 (B.O. and A.D.), 14.04.2005 (P.O. and A.M.), 28.04.2005 (E.D.), 19.09.2005 (A.K. and R.S.), 24.04.2006 (N.F. and J.E.); final exams (Hauptprüfung Diplom) on 12.05.2005 (C.G.), 16.06.2005 (C.B.), 10.08.2005 (D.K.), 28.10.2005 (Frank Freimuth), 06.04.2006 (Tobias Gottwald).

2.3 Supervision of diploma theses

(none in 2005–2007)

2.4 Results of evaluations

In all of the lectures and seminars listed in section 2.1, standard computer readable evaluation forms have been handed out to the students, usually at the last possible date. With the exception of the summer course 2005 (in this case, the forms were apparently misplaced by the students), the answers have been analyzed by the Center for Quality Assurance and Development (ZQ) with the following main results (statistics for the overall grade assigned by the students):

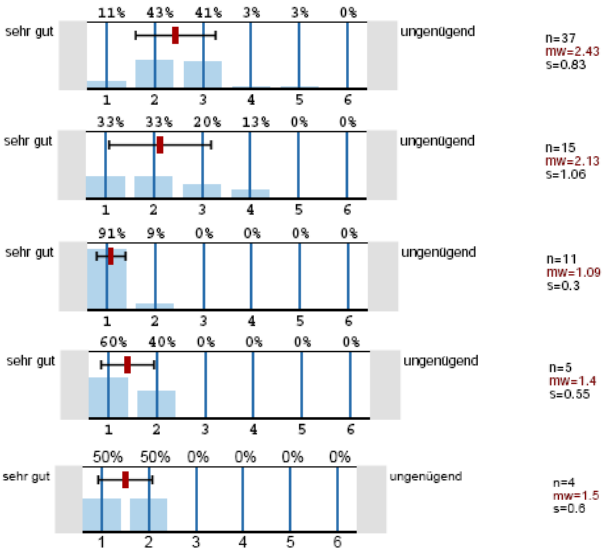
Ergänzungsvorlesung zur Physik I
good (2.4)

Ergänzungsvorlesung zur Physik II
good (2.1)

Proseminar zur Physik I/II
very good (1.1)

Computer simulations in statistical physics
very good (1.4)

Moderne numerische Methoden der Festkörperphysik very good (1.5)



Note that in the course **Computer simulations in statistical physics**, evaluations have been performed separately for each of the two lecturers; in contrast, the evaluation for the **Proseminar zur Physik I/II** is summarily both for K. Wendt and me. A significant part of both simulation related lectures were practical exercises and tutorials which have been graded as "good" (1.6) in the case of **Computer simulations in statistical physics** and "very good" (1.0) in the case of **Moderne numerische Methoden der Festkörperphysik**.
Complete evaluation analyses (as prepared by the ZQ) are attached; most of this information is also available online: `http://komet337.physik.uni-mainz.de/Bluemer/eval`

2.5 Further information

I have served as a referee for Cusanuswerk (a funding agency for gifted students) in 2/2007; the recommended student was accepted.
Replacement lectures (for Immanuel Bloch) "Experimental Physics II" on 28.06.2006 and 29.06.2006 – about 130 students.
Since spring 2007, I am one of the advisors in the "Seminar zum Fortgeschrittenenpraktikum", originally/mainly a seminar in experimental physics. Under my supervision, a student has prepared and given a talk on *BCS theory of superconductivity* in 4/2007; I am currently supervising a second student in the same topic.

3 Academic administration

3.1 Membership in university committees

Participation in the following committees:

- information technology (“Rechnerkommission”)
- appointment committee: W3 position for Numerical Mathematics (successor Prof. Jüngel)

3.2 Further administrative duties for units of the university

Supervision of the seminar/event database and web platform used by the Institutes for Physics and Nuclear Physics: `http://seminar.physik.uni-mainz.de/`.

4 Further professional education

Participation in the following (evening) training seminars organized by the Center for Quality Assurance and Development (ZQ) as part of the program “Auf dem Weg zur Professur”

20.04.2005 ”Gute Lehre – schlechte Lehre”
29.06.2005 “Seminargestaltung”
20.07.2005 “Elektronische Unterstützung der Lehre”
04.10.2005 “Arbeitsrecht”
29.11.2005 ”Finanzen der Universität”
07.02.2006 ”Workshop: Führung”
16.02.2006 ”Bewerbung und Berufung”
07.02.2007 ”Hörerbefragungen und Forschungsindikatoren”
06.03.2007 ”Atmen – Sprechen – Körpersprache”
07.03.2007 ”Workshop: Präsentieren”
11.06.2007 ”Forschung und Antragswesen”
18.07.2007 ”Bewerbung, Berufungskommission, Berufungsvortrag”

14.-16.09.2006 Participation (upon recommendation by the university) in a media training for scientists at the Journalistisches Seminar Mainz, supported by the Stiftung Rheinland-Pfalz für Innovation.