

# Hartmut Monien

## Curriculum Vitae

Physikalisches Institut  
Universität Bonn  
Nußallee 12  
D-53115 Bonn  
Federal Republic Germany

Tel.: +49-228-73-7283  
Fax.: +49-228-73-3223  
Sec.: +49-228-73-3247  
monien@th.physik.uni-bonn.de  
<http://cond-mat.uni-bonn.de>

born: Kiel, Germany, January 15th, 1959  
nationality: german

### Education and Career

10/1/79 – 9/31/82	Technical University Hannover: undergraduate studies Degree: <b>Vordiplom</b>
9/31/82 – 7/2/85	University Hamburg Diploma Thesis 7/2/85 Supervisor: Prof. Dr. L. Tewordt Title: <i>NMR in the <math>A_1</math> phase of <math>^3\text{He}</math>.</i>
7/3/85 – 8/13/87	University Hamburg Doctoral Thesis, 8/13/87 Supervisor: Prof. Dr. L. Tewordt Title: <i>Transport and equilibrium properties of unconventional superconductors</i>
8/1/85 – 8/31/87	<b>Research fellow</b> at the University Hamburg
9/9/87 – 12/31/87	<b>Postdoctoral Fellow</b> at NORDITA, Copenhagen, Denmark, with Prof. C. J. Pethick and Prof. D. Pines.
1/8/88 – 8/20/89	<b>Postdoctoral Research Associate</b> at the University of Illinois at Urbana –Champaign, USA, with Prof. C. J. Pethick and Prof. D. Pines.
8/21/89 – 10/31/90	<b>Visiting Research Assistant Professor</b> at the University of Illinois at Urbana – Champaign, USA
11/1/90 – 8/31/93	<b>IBM Senior Postdoctoral Research Physicist</b> at the Institute for Theoretical Physics, UCSB, Santa Barbara, USA with Prof. J. R. Schrieffer and Prof. D. J. Scalapino
9/1/93 – 9/30/95	<b>Research Physicist</b> in the group of Prof. T. M. Rice at the ETH Zürich, Switzerland
10/1/95 – present	<b>Full professor (C4)</b> at the University Bonn, Germany
2/23/00 - 8/15/00	<b>JSPS Fellow</b> (sabbatical) at the Yukawa Institute, Kyoto, Japan

**honors**

- IBM postdoctoral fellowship (90)
- fellowship of the Japanese Society for Promotion of Science (JSPS) (00)

**Professional societies**

- member of the American Physical Society
- member of the German Physical Society

## Teaching

### Undergraduate courses

- fall 96/97 quantum mechanics
- fall 97/98 introductory theory of condensed matter systems
- fall 99/00 classical mechanics
- spring 01 advanced quantum mechanics

### Graduate courses

- spring 96 many body theory
- spring 97 advanced quantum mechanics
- spring 98 seminar on basic concepts in condensed matter theory
- fall 98/99 quantum field theory of condensed matter systems
- spring 99 quantum magnetism,
- fall 00/01 quantum mechanics
- spring 02 condensed matter theory
- fall 02/03 quantum mechanics

### Seminars

- fall 97/98 current problems in quantum field theory of condensed matter systems
- fall 98/99 current problems in quantum magnetism
- fall 00/01 modern computational methods in theoretical condensed matter physics

### supervised theses

- C. Nieten, Diplom 1997, *Dynamical Mean Field Theory for Coupled Strongly Correlated Planes*
- T. D. Kühner, Diplom 1997, *Application of the Density-Matrix Renormalization Group to the Bose-Hubbard Model*
- M. Reuhl, Diplom 1997, *Phasenübergänge in Orientierungsgläsern*
- M. Niemeyer, Diplom 1997, *Magnetic Field and the Mott Transition in the Bose-Hubbard Model*
- M. Linn, Diplom 1998, *Luttinger-Behavior of Ultra Cold Bose Gases in One-Dimensional Magnetic Traps*
- A. Amann, Diplom 1998, *Anwendung der Renormierungsgruppe und der  $1/N$  Entwicklung auf die  $SO(5)$  Theorie der Hochtemperatursupraleiter*
- Petra Schmidt, Diplom 1999, *Time-dependent dynamical mean-field theory*
- Simon Trebst, Diplom 1999, *Thermodynamics and dynamics of the spin-Peierls transition with non-adiabatic phonons*
- C. Ritter, Dr. rer. nat, 1999, *Applications of the Density-Matrix Renormalization Group to  $Z_3$  and  $Z_5$ - quantum spin chains*
- T. D. Kühner, Dr. rer. nat, 1999, *Dynamics with Density-Matrix Renormalization Group*

- M. Linn, Dr. rer. nat, 2001, *Vortex Stability in Weakly Interacting Asymmetric Bose-Einstein Condensates*
- S. Trebst, Dr. rer. nat, 2002, *Bound States in Strongly-Correlated Electronic and Magnetic Systems*
- A. Grzesik, Diplom 2003, *Bound States in  $tJ$  - Ladders and Bilayers*
- A. Fuhrmann, Diplom 2003, *Quantum Monte Carlo Simulation of Strongly Correlated Electrons*

### Research statement:

Although I take interest in many different fields of physics my particular specialization is in the field of condensed matter theory. systems a broad range of theoretical methods from phenomenology for extracting the basic physics from experimental information and returning useful information to the experimentalists to topics of purely theoretical interest like the stability of the Fermi liquid state in the gauge field theories with transverse interactions. Currently a major part of my work is devoted to developing novel computational methods for quantum lattice models. Many interesting problems in condensed matter theory are connected with strong coupling and/or multiple energy scales (e.g. the Mott transition) and are therefore very hard to handle analytically. To obtain more detailed insight, and eventually get quantitative understanding, computational physics is needed. But even today with all the progress in computer hardware, the success of brute force use of computer power is very limited - instead sophisticated algorithms are called for which exploit the physics of the problem in much more detail. The *Density Matrix Renormalization Group* and its extension to dynamical properties, *Dynamical Mean Field Theory* in combination with band structure theory and *Series Expansions* for single and two-particle properties are examples that illustrate the potential of a new kind of methods in computational physics which I hope to exploit in the future. The following paragraphs give an overview over some of my past and present research interests.

### Perspective

#### Novel Numerical Techniques:

Computational Physics is an increasingly important tool for obtaining insight into important material properties. While established techniques such as band structure have been very successful in understanding energetics of a wide variety of materials, our understanding of spectral properties, especially of 'strongly correlated' materials, is still very primitive. A direct numerical attack is impractical because the Hilbert space of a quantum system grows exponentially with system size. However, several very interesting recent advances in theoretical technique, including the 'Dynamical Mean Field' method and the 'Density Matrix Renormalization Group', have allowed very considerable progress. My research program centers on improving these techniques, applying them to forefront problems in condensed matter physics, and searching for new methods and implementations.

The power of these approaches has not been fully exploited. The combination of intelligent modeling with modern software methods has a great potential for extending our understanding of condensed matter and holds the promise for a quantitative analysis of materials properties. My group has developed a new *Object Oriented Method* which exploits the capabilities of modern computer languages such as C++ to enable the use of complex and intelligently designed algorithms, which apparently cannot otherwise be implemented. An additional advantage is the separation of the interface. We have used these techniques to solve several problems previously believed to be computationally intractable, including the effect of *Renormalization of the Spin-Peierls Transition due to Phonon Dynamics*, (Europhys. Lett. **56**, 268 (2001)). We propose to continue to develop and exploit these methods, and in particular to use them to combine renormalization group and series expansion techniques. Probably the most interesting achievement in one of our current projects (a collaboration with a group at

Columbia University) is a new relatively general extension of the DMFT for studying short range correlations. This method allows in principle to study the dynamical correlation functions in momentum space. We are currently applying this method to the double exchange model and the two-dimensional Hubbard model.

## Achievements:

### Josephson effect in superfluid $^3\text{He}$

*H. Monien and L. Tewordt, J. Low Temp. Phys.* **62**, 277 (1986)

The experimental observation of Shapiro steps in superconducting weak links confirmed the theoretical framework laid out by Josephson in his original paper. For over thirty years much effort has been focussed on the searches of equivalent phenomena in superfluids. In 1986 we proposed a theory for Josephson oscillation in superfluid  $^3\text{He}$ . Recently this effect has been observed (R.W. Simmonds et al. *Phys. Rev. Lett.* **87**, 035301-1 (2001)), and some additional unexpected features in the superfluid  $^3\text{He}$  weak links were found which I plan to investigate.

### Phenomenology of High Temperature Superconductors

*A. J. Millis, H. Monien and D. Pines, Phys. Rev.* **B42**, 167 (1990)

High temperature superconductors still present one of the most interesting and challenging problems in modern condensed matter theory. With many competing theories for the complicated many body ground state experiment has to be the guideline. In the beginning it was not clear if the system possessed only one electronic degree of freedom or many components. Our work with A. J. Millis and D. Pines, showed for the first time based on a phenomenological analysis of the NMR data, that the system indeed has only one relevant degree of freedom and that antiferromagnetic spin fluctuations continue to play a role in the unusual normal state - and therefore supported strongly the suspicion that the HTC compounds are indeed driven by electronic correlations. This work had a significant impact on theoretical and experimental work. Many theoretical approaches used and still use the phenomenological form of the dynamical structure factor trying to explain various experimental puzzles in the HTC compounds.

### Transverse Interaction in Transport

*G. Baym, H. Monien, C. J. Pethick and D. G. Ravenhall, Phys. Rev. Lett.* **64(16)**, 1867(1990)

For theories of the early universe and heavy ion collisions it is vital to understand the transport in ultrarelativistic plasmas. For a long time it was not clear how, even in principle, to obtain nonzero transport cross sections if the long range magnetic forces are taken into account. In collaboration with G. Baym, C. J. Pethick and D. G. Ravenhall we finally understood the role of *dynamical screening* and were able to calculate transport coefficients. This is a significant conceptual advance and is now regarded as a classic textbook material on this subject (see e.g. "thermal field theory", Michel Le Bellac, Cambridge University Press, 1996).

### Impurity Scattering in Non S-Wave Superconductors

*H. Monien, K. Scharnberg and D. Walker, Solid State Commun.* **63**, 263 (1987)

In many of the *heavy fermion systems* the effect of impurity scattering in the unconventional superconducting state was apparently very strong. Our work converted this idea into a general theory of transport in impure *p* and *d* wave heavy fermion superconductors which gave a detailed understanding of the role of resonant impurity scattering for transport and equilibrium properties of anisotropic superconductors.

## Quantum Phase Transitions

*J. K. Freericks, and H. Monien, Phys. Rev. B* **53**, 2691 (1996)

Experiments on Josephson-Junctions arrays, thin superconducting films and ultracold atoms in optical lattice are fascinating because they exhibit *Quantum Phase Transitions (QPT)*. In a series of papers we were able to obtain a *quantitative understanding* of the transition from a superfluid to a Mott insulator for the one and two-dimensional Bosonic Hubbard models (see e.g. S. Sachdev in “Quantum Phase Transitions”, Cambridge University Press, 1999). Recently this transition has been observed experimentally in a gas of ultracold atoms (Nature **415**, 39 (2002)).

## Novel Numerical Techniques for Strongly Interacting Systems

*S. Trebst, H. Monien, C.J. Hamer, Z. Weihong, R.R.P. Singh, Phys. Rev. Lett. Phys. Rev. Lett.* **85**, 4373, (2000)

In collaboration with my student T. D. Kühner and S.R. White (T. D. Kühner, S. R. White and H. Monien, Phys. Rev. **B61**, 12474 (2000)) we finally understood how to extract *dynamical properties* of strongly correlated systems density matrix renormalization group - this had been tried many times before and is a major step forward and is expected to have significant impact on the study of one dimensional systems. The development of strong coupling series expansion techniques for two-particle scattering allows for the first time to study quantitatively the appearance of bound states and two-particle continua in strongly correlated systems. We actually predicted a bound state in spin ladders (Phys. Rev. Lett. **85**, 4373 (2000)) which was latter observed experimentally (M. Windt et al., Phys. Rev. Lett. **87**, 127002 (2001)). More recently we have found a way to apply renormalization group techniques to the strong coupling expansions. The combination of renormalization group ideas with numerical techniques holds great promise for a quantitative description of strongly correlated systems.

**papers in refereed journals**

- H. Monien, L. Tewordt,  
*Longitudinal Magnetic Resonance in the  $A_1$  Phase of Superfluid  $^3\text{He}$ ,*  
J. Low Temp. Phys. **60**, 323 (1985).
- H. Monien, L. Tewordt,  
*Theory of Josephson Flow Oscillations in Superfluid  $^3\text{He}$ ,*  
J. Low Temp. Phys. **62**, 277 (1986).
- H. Monien, K. Scharnberg, L. Tewordt and N. Schopohl,  
*Effects of Spin-Orbit Interaction and Crystal Fields on Superconducting  $p$ -Wave States and their Collective Excitations in Cubic Systems,*  
Phys. Rev. **B34**, R3487 (1986).
- H. Monien, K. Scharnberg, L. Tewordt, N. Schopohl,  
*Effects of Spin-Orbit Interaction and Crystal Fields on Superconducting  $p$ -Wave States and their Collective Excitations in Cubic Systems,*  
J. Low Temp. Phys. **65**, 13 (1986).
- K. Scharnberg, D. Walker, H. Monien, L. Tewordt, and R. A. Klemm,  
*Attenuation of Ultrasound in  $p$ -Wave Superconductors,*  
Solid State Commun. **60**, 535 (1986).
- H. Monien, K. Scharnberg, L. Tewordt, and D. Walker,  
*Specific Heat, Thermal Conductivity, and Ultrasound Attenuation in  $d$ -Wave Superconductors,*  
Solid State Commun. **61**, 581 (1987).
- H. Monien and L. Tewordt,  
*Josephson Flow Oscillations in Superfluid  $^3\text{He-B}$ ,*  
Can. J. Phys. **65**, 1388 (1987).
- H. Monien, K. Scharnberg, and D. Walker,  
*Resonant Impurity Scattering in Anisotropic Superconductors: Effects of Arbitrary Phase Shifts and Particle Hole Asymmetry,*  
Solid State Commun. **63**, 263 (1987).
- H. Monien, L. Tewordt, and K. Scharnberg,  
*Ultrasound Attenuation Due to Order Parameter Collective Modes in Impure Anisotropic  $p$ -Wave Superconductors,*  
Solid State Commun. **63**, 1023 (1987).
- St. Lenck, H. Monien, and L. Tewordt,  
*Ultrasound Attenuation Peaks Due to Order Parameter Collective Mode in Impure Superconductors with Strong Particle-Hole Asymmetry,*  
J. Low Temp. Phys. **70**, 309 (1987).

- H. Monien, K. Scharnberg, D. Walker,  
*Attenuation of Longitudinal and Transverse Ultrasound in p- and d-Wave Superconductors*,  
Physica **B148**, 45 (1987).
- J. Keller, K. Scharnberg, H. Monien,  
*Free Energy of Anisotropic Superconductors*,  
Physica **C152**, 302 (1988).
- D. Fay, R. A. Klemm and H. Monien,  
*Numerical Investigation of Competing Spin-Spin Interactions in a Two-Dimensional Ising Model for  $La_{2-x}CuO_{4-y}$* ,  
Phys. Rev. **B37**, 9359 (1988).
- D. Fay, R. A. Klemm and H. Monien,  
*Numerical Investigation of Competing Spin-Spin Interactions in a Two-Dimensional Ising Model for  $La_{2-x}CuO_{4-y}$* ,  
Physica **C153**, 1289 (1988).
- C. J. Pethick, G. Baym and H. Monien,  
*Kinetics of Quark-Gluon Plasmas*,  
Nuclear Physics **A498**, 313 (1989).
- H. Monien and A. Zawadowski,  
*Theory of Interband Electron Raman Scattering in  $YBa_2Cu_3O_7$* ,  
Phys. Rev. Lett. **63**, 911 (1989).
- H. Monien and D. Pines,  
*Spin Excitations and Pairing Gaps in the Superconducting State of  $YBa_2Cu_3O_{7-\delta}$* ,  
Phys. Rev. **B41**, 6297 (1990).
- H. Monien and A. Zawadowski,  
*Theory of Raman Scattering with Final-State Interaction in the high  $T_c$  BCS Superconductors: Collective Modes*,  
Phys. Rev. **B41**, 8798 (1990).
- G. Baym, H. Monien, C. J. Pethick, and D. G. Ravenhall,  
*Transverse Interactions and Transport in Relativistic Quark-Gluon and Electromagnetic Plasmas*,  
Phys. Rev. Lett. **64**, 1867 (1990).
- H. Monien, D. Pines and C. P. Slichter,  
*Spin and Charge Excitations in  $YBa_2Cu_3O_7$ , Constraints from Spin Relaxation Rates in the Normal State*,  
Phys. Rev. **B41**, 11120 (1990).
- A. J. Millis, H. Monien and D. Pines,  
*Phenomenological Model of Nuclear Relaxation in the Normal State of  $YBa_2Cu_3O_7$* ,  
Phys. Rev. **B42**, 167 (1990).

- H. Monien, D. Pines and M. Takigawa,  
*On the Application of Antiferromagnetic Fermi Liquid Theory to NMR Experiments on  $YBa_2Cu_3O_{6.63}$ ,*  
Phys. Rev. **B43**, 258 (1991).
- H. Monien, P. Monthoux, and D. Pines,  
*On the Application of Antiferromagnetic Fermi Liquid Theory to NMR Experiments on  $La_{1.85}Sr_{0.15}CuO_4$ ,*  
Phys. Rev. **B43**, 275 (1991).
- G. Baym, H. Monien, C. J. Pethick and D. G. Ravenhall,  
*Transverse Interactions and Transport in Quark-Gluon and QED Plasmas,*  
Nuclear Physics **A525**, 415 (1991).
- W. Brenig, A. P. Kampf, H. Monien and J. R. Schrieffer,  
*Anharmonic Local Moment Fluctuations in the Hubbard Model,*  
Phys. Rev. **B44**, R10381 (1991).
- A. J. Millis and H. Monien,  
*Antiferromagnetic Correlations and Nuclear Relaxation in High  $T_c$  Superconductors: A Critical Reexamination,*  
Phys. Rev. **B**, 3059 (1992).
- H. Monien and K. Bedell,  
*Collective Modes and Sum Rules for the Hubbard Model in the Spin Density Wave Regime,*  
Phys. Rev. **B**, R3164 (1992).
- W. Brenig and H. Monien,  
*Theory of Raman Scattering on Spin Fluctuations in Nearly Antiferromagnetic Materials,*  
Solid State Commun. **83**, 1009 (1992).
- B. Blok and H. Monien,  
*Gauge Theories of the High Temperature Superconductors,*  
Phys. Rev. **B47**, R3454 (1992).
- A. J. Millis and H. Monien,  
*Spin Gaps and Spin Dynamics in  $La_{2-x}Sr_xCuO_4$  and  $YBa_2Cu_3O_7$ ,*  
Phys. Rev. Lett. **70**, 2810 (1993).
- R. T. Scalettar, A. Moreo, E. Dagotto, L. Bergomi, H. Monien,  
*Ground State Properties of the Hubbard Model on a  $C_{60}$  Cluster,*  
Phys. Rev. **B47**, 12316 (1993).
- P. B. Littlewood, J. Zaanen, G. Aeppli, H. Monien,  
*Spin Fluctuations in a Two-Dimensional Marginal Fermi Liquid,*  
Phys. Rev. **B48**, 487-498 (1993).

- J. K. Freericks and H. Monien,  
*Phase Diagram of the Bose-Hubbard Model*,  
Europhys. Lett. **26**, 545 (1994).
- H. Monien and T. M. Rice,  
*Cross Relaxation and Bilayer Coupling in  $Y_2Ba_4Cu_7O_{15}$* ,  
Physica **C235**, 1705 (1994).
- A. J. Millis and H. Monien,  
*Spin Gaps and Spin Dynamics in  $YBa_2Cu_3O_{7-\delta}$* ,  
Phys. Rev. **B50**, 16606 (1994).
- H. Monien and A. W. Sandvik,  
*Interplane Relaxation in  $Y_2Ba_4Cu_7O_{15}$* ,  
J. Low Temp. Phys. **99**, 343 (1995)
- A. J. Millis, L. B. Ioffe and H. Monien,  
*Spin Gaps in High Temperature Superconductors*  
J. of Physics and Chemistry of Solids **56**, 1641 (1995)
- J. K. Freericks, and H. Monien,  
*Strong Coupling Expansion for the Pure and Disordered Bose-Hubbard Model*  
Phys. Rev. **B53**, 2691 (1996)
- A. J. Millis and H. Monien,  
*Bilayer Coupling in the Yttrium-Barium Family of HTC - Superconductors*  
Phys. Rev. **B54**, 16172 (1996)
- H. Monien,  
*Spectral Properties of Strongly Correlated Systems*  
Physica **B244**, 81 (1998)
- D. Meschede, V. Gomer and H. Monien,  
*Atomic Bose-Einstein Condensates: A Model for Macroscopic Quantum Systems*,  
Naturwissenschaften **85**, 203 (1998)
- H. Monien, M. Linn and N. Elstner,  
*Trapped one-dimensional Bose gas as a Luttinger liquid*,  
Phys. Rev. **A58**, R3395 (1998)
- T. Kühner and H. Monien,  
*Phases of the One-Dimensional Bose-Hubbard Model*,  
Phys. Rev. **B58**, R14741, (1998)
- M. Niemeyer, J. K. Freericks and H. Monien,  
*The Mott Transition of Strongly Correlated Bosons in a Magnetic Field*,  
Phys. Rev. **B60**, 2357 (1999)

- N. Elstner and H. Monien,  
*Dynamics and Thermodynamics of the Bose-Hubbard model*,  
Phys. Rev. **B59**, R12184 (1999)
- A. J. Millis and H. Monien,  
*Singularities and Pseudogaps in the Density of States of Peierls Chains*,  
Phys. Rev. Lett. **84**, 2546 (2000)
- T. D. Kühner, S. R. White and H. Monien,  
*The One-Dimensional Bose-Hubbard Model with nearest-neighbor interaction*,  
Phys. Rev. **B61**, 12474 (2000)
- A. J. Millis and H. Monien,  
*Pseudogaps in One-Dimensional Models with Quasi-Long-Ranged-Order*  
Phys. Rev. **B61**, 12496 (2000)
- S. Trebst, H. Monien, C. J. Hamer, Z. Weihong, R. R. P. Singh,  
*Strong-Coupling Expansions for Multiparticle Excitations:  
Continuum and Bound States*,  
Phys. Rev. Lett. **85**, 4373, (2000).
- Weihong Zheng, C.J. Hamer, R.R.P. Singh, Simon Trebst, Hartmut Monien,  
*Linked Cluster Series Expansions for Two-Particle Bound States*,  
Phys. Rev. **B63**, 144411-1, (2001)
- Weihong Zheng, C.J. Hamer, R.R.P. Singh, Simon Trebst, Hartmut Monien,  
*Deconfinement Transition and Bound States in Frustrated Heisenberg Chains:  
Regimes of Forced and Spontaneous Dimerization*,  
Phys. Rev. **B63**, 144410-1 (2001)
- Manfred Sigrist and Hartmut Monien,  
*Phenomenological Aspects of the 3K-Phase in  $Sr_2RuO_2$* ,  
Journal of the Physical Society of Japan **70**, 2409 (2001)
- S. Trebst, N. Elstner and H. Monien,  
*Renormalization of the Spin-Peierls Transition due to Phonon Dynamics*,  
Europhys. Lett. **56**, 268 (2001)
- H. Monien  
*Exact Results for the Crossover from Gaussian to Non-Gaussian Order Parameter  
Fluctuations in Quasi One-Dimensional Electronic Systems* ,  
Phys. Rev. Lett. **87**, 126402 (2001)
- H. Monien  
*What is wrong with paramagnons?*,  
J. Low Temp. Phys., **126** (3/4) 773 (2002)

- K. Schmidt, H. Monien and G. Uhrig,  
*Rung-singlet Phase of the Antiferromagnetic  $S = 1/2$  two-leg spin-ladder with four-spin cyclic exchange interaction*  
Phys. Rev. **B67**, 184413 (2003)

### preprints

- P. Schmidt and H. Monien,  
*Nonequilibrium dynamical mean-field theory of a strongly correlated system,*  
cond-mat/0202046, Phys. Rev. Lett. accepted for publication
- S. Okamoto, A.J. Millis, H. Monien, A. Fuhrmann,  
*Fictive Impurity Models: an Alternative Formulation of the Cluster Dynamical Mean Field Method,*  
cond-mat/0306178, Phys. Rev. **B** accepted for publication

### manuscripts in preparation

- S. Trebst, A. Grzesik, H. Monien and M. Sgrist,  
*Pairing in Kondo-Lattice Models*
- A. Grzesik, S. Trebst and H. Monien,  
*Hole Pairing in the Bilayer  $tJ$  Model*
- A. J. Millis and H. Monien,  
*A New Extended DMFT for the Double-Exchange Model*
- T. Hand, H. Kroha and H. Monien,  
*Dynamical Properties of a Single Kondo Impurity on a Carbon Nanotube*

**invited talks**

- *“Josephson Oscillation in superfluid  $^3\text{He-B}$ ”*,  
Banff Conference on Quantum Fluids and Solids, Banff, Canada 1986
- *“Influence of the Antiferromagnetic Fluctuations on the NMR in the CuO High Temperature Superconductors”*,  
Nato Advanced Research Workshop on Dynamics of Magnetic Fluctuations in High Temperature Superconductors, October 9-14, Crete, Greece 1989
- *“Antiferromagnetic Fluctuations on the NMR in the CuO High Temperature Superconductors”*,  
International Seminar on High Temperature Superconductivity, Dubna, USSR 1990
- *“Present understanding of the NMR experiments in the CuO materials”*,  
Workshop on “low dimensional strongly correlated electron systems”,  
Budapest, Hungary, 5 - 10 September 1991
- *“Aspects of Spin Dynamics in the Cuprate Superconductors”*,  
workshop on “Phase Separation in Cuprate Superconductors”, Erice, Sicily, Italy, 1992
- *“The Phase diagram of the Bose Hubbard Model”*,  
workshop on “Strongly Correlated Materials”, Los Alamos, New Mexico 1992
- *“Spin gaps and Spin dynamics in the Cuprate Superconductors”*,  
workshop on “Correlated Electron Theory”, Los Alamos, New Mexico 1992
- *“Spin gaps and Spin dynamics in the Cuprate Superconductors”*,  
At the 13th general conference of the European Physical Society, Regensburg, Germany 1993
- *“Bilayer correlations in the Cuprate Superconductors”*,  
Euroconference for “Surface Magnetism and Strongly Correlated Materials”, Turino, Italy, 1994
- *“NMR in the Cuprate Superconductors”*,  
Euroconference for “Magnetic Correlations, Metal-Insulator Transition and Superconductivity”, Würzburg, Germany, 1994
- *“Strong Coupling Expansion for the Bose Hubbard Model”*,  
Euroconference for “Crossover Phenomena in Condensed Matter Physics, from Weak to Strong Coupling”, Turino, Italy, 1994
- *“Fluctuation Effects on the Optical Conductivity in 1D”*,  
“Conference on fluctuations in one dimension”, University of California Los Angeles, California 1995

- *"Interplane Relaxation in the Cuprate Superconductors"*,  
Euroconference for "Microscopic Properties of the High Temperature Superconductors",  
Turino, Italy, 1995
- *"What do we know about Spin Excitation in the Cuprates?"*,  
workshop on "Physics of the Cuprate Superconductors", Erice, Italy, 1995
- 3/18/96, APS March Meeting St. Louis,  
*"Theory of Bilayer Coupling in High Temperature Superconductors"*
- 3/11/96, ITP, Santa Barbara,  
*"Bilayer coupling in HTC superconductors"*
- 5/17/96, ISI Torino, workshop on  
"The role of dimensionality in strongly correlated systems",  
*"Strong coupling expansion of the Bose-Hubbard Model"*
- 8/8/96, MOS 96 Karlsruhe,  
*"Spin correlations in High Temperature Superconductors"*
- 7/25/96, University Pisa,  
Conference on "Coherence in condensed matter",  
*"Spin correlation in YBCO"*
- 10/5/96, FU Berlin,  
International Symposium on "Theoretical Aspects of Electronic Correlations in High-T<sub>c</sub>-Superconductors",  
*"Theory of Bilayer Coupling in YBCO"*
- 3/10/97, Engelberg, Switzerland,  
6. Monbusho Meeting,  
*"Coherence and incoherence in coupled strongly correlated planes"*
- 2/26/97 - 2/27/97, Weizmann Institute, Rehovot, Israel,  
German-Israeli winter school on Strongly Correlated Electron Systems,  
*"Non Fermi Liquid Effects"*
- 5/2/97, Institute for Scientific Interchange Turino,  
workshop on *"Spin and Pseudogaps in HTC Superconductors"*,  
*"Dynamical mean field theory for coupled strongly correlated planes"*
- 7/9/97, Ascona, Switzerland,  
International Conference on "Low Energy Electrodynamics in Solids",  
*"Pseudogaps in One-Dimensional Models with Quasi-Long-Range-Order"*
- 8/15/97, Center for Material Science, Los Alamos National Laboratory,  
workshop on "Many Body Physics",  
*"Coherence and incoherence in strongly correlated systems"*

- 10/2/97 MPI Dresden,  
workshop "Korrelationstage 97", "*Pseudogaps in strongly correlated systems*"
- 5/25/98 MPI Dresden,  
workshop on "computational methods and electronic correlations":  
COMPEC 98, "*Suppression of coherence in coupled strongly correlated systems.*"
- 6/6/98 University Augsburg,  
workshop on "Development and Applications of the Dynamical Mean Field Theory", "*Coupled strongly correlated electronic systems.*"
- 7/9/98 MPI Dresden,  
German-Japanese workshop on strongly correlated electron systems,  
"*Coherence and Incoherence in transport of HTC superconductors.*"
- 9/3/99 University of California at Santa Barbara  
workshop on "Quantum Magnetism in Novel Materials and Geometries", "*Anisotropic superconductivity and collective modes in Ruthenates*"
- 15/2/99 University Karlsruhe  
Graduiertenkolleg Karlsruhe, "*Quantum phase transitions in strongly correlated materials*"
- 11/9/00 Sapporo  
German-Japanese workshop on "strongly correlated materials", "*Series expansion techniques for multiparticle excitations*"
- 2/17/01 MPI Dresden,  
workshop "Korrelationstage",  
*Two particle excitations in the Kondo insulator (from strong coupling expansions)*
- 10/3/01 ISSP, Tokyo University,  
Todai International Symposium on "Correlated electrons",  
*Exact Results on Non-Gaussian Orderparameter-Fluctuations*
- 6/12/02 University Groningen,  
Conference Frontiers in Condensed Matter Physics: Electronic Structure and Properties,  
*Dynamical Properties of doped Kondo-insulators*
- 9/12/02 Institute for Theoretical Physics, UCSB,  
Workshop on "Realistic Theories of Correlated Electron Materials",  
*Nonequilibrium Dynamical Mean Field Theory*
- 5/11/02 Physics Center of the German Physical Society, Bad Honnef,  
Conference on "Quantum Magnetism:  
Microscopic Techniques For Novel States Of Matter",  
*Single and Two-particle Excitations of the tJ-Model for small dopings*

**Other recent talks (2002-)**

- 2/15/02 Boston University,  
*Novel Numerical Methods for Dynamical Properties of Strongly Correlated Systems*
- 3/23/02 University of British Columbia,  
*Novel Numerical Methods for Dynamical Properties of Strongly Correlated Systems*
- 3/13/02 Institute for Solid State Physics, Tokyo University,  
Physics Colloquium: *The Mott Transition in Bosonic Systems*
- 3/8/02 Yukawa Institute, Kyoto University,  
*Non-Gaussian Fluctuations and the Pseudogap*
- 6/7/02 Berlin Physics Colloquium,  
(Common Physics Colloquium of the Humboldt University Berlin , Technical University Berlin and Freie Universität Berlin),  
*From High Temperature Superconductors to Ultracold Atoms: The Physics of the Mott transition*
- 9/12/02 ITP Santa Barbara,  
*Nonequilibrium DMFT,*  
Workshop on Realistic Theories of Correlated Electron Materials
- 1/10/03 Université Lausanne,  
*Short Range Correlations and DMFT*
- 1/17/03 ETH Zürich *Fictitious Impurity Models and DMFT*
- 2/27/03 Max Planck Institute for Complex Studies, Dresden,  
*Single Particle and Two Particle of Doped Kondo Insulators,*  
Workshop on Correlated Electronic Systems
- 3/27/03 National Center for Theoretical Physics, Hsin Chu, Taiwan,
  - *From HTC to BEC*
  - *Novel Numerical Methods for Strongly Correlated Systems*
- 3/31/03 National Cheng Chung University, Taiwan,  
*From HTC to BEC*
- 4/1/03 Daifung University, Taichung, Taiwan,
  - *From HTC to BEC*
  - *Novel Numerical Methods for Strongly Correlated Systems*
- 4/8/03 Academia Sinica, Taipeh, Taiwan,  
*Novel Numerical Methods for Strongly Correlated Systems*

- 7/17/03 University Saarbrücken,  
*Physics Colloquium: From HTC Superconductors to BEC*
- 8/19/03 Aspen Institute for Physics,  
*Strong disorder with Non-Gaussian Correlation,*  
Workshop on Disorder and Interaction in 2D
- 9/25/03 Yukawa Institute Kyoto,  
9/30/03 ISSP, Tokyo University,  
10/02/03 RIKEN, Tokyo,  
*Fictive Impurity Models: A New Approach to Spatial Correlations*