List as of July 13, 2006

Anton Arnold (Vienna), June 3 - June 17

Title: "Quantum-kinetik Fokker-Planck equations: global-in-time solutions and dispersive effects"

Abstract: Quantum-Fokker-Planck equations play an important role for the modeling of nano-semiconductor devices, e.g. They combine the description of the electron transport in a selfconsistent electric field (Hartree potential) with diffusive effects of the electron-phonon interaction.

For the mathematical analysis (existence of global-in-time classical solutions) this model lends itself to two different approaches: density matrix operators (however, only for the whole space) and the kinetic Wigner formulation. We shall emphasize the latter approach, where the main analytical difficulty stems from defining the particle density. This shall be solved by exploiting dispersive effects of the free transport operator, and it is inspired by strategies from the classical Vlasov-Fokker-Planck equation.

Anna Dall'Acqua (Munich), June 24 - July 1

The clamped plate equation and positivity

Abstract: A partial differential equation has the positivity preserving property if a positive source term leads to a positive solution. The clamped plate equation

$$\begin{cases} \Delta 2u = f & \text{in } \Omega, \\ u = \frac{\partial}{\partial \nu} u = 0 & \text{on } \partial\Omega, \end{cases}$$

does not have this property in general planar domains. We will present some examples of convex and non-convex domains on which it holds. Moreover, we show that the solution operator for the clamped plate equation in two-dimensional regular bounded domains can be split in a positive part and a possible negative part which both satisfy the Dirichlet boundary condition. The positive part contains the singularity and the other inherits the full regularity of the boundary.

Riccardo Adami (Rome), June 1 -June 17

Title: A simple many-body system for the study of the quantum decoherence.

Abstract: We consider a system of particles of two species, that we call "heavy" and "light". Interactions are allowed only between couples of particles of different kind. An external field acting on the heavy particles can be taken into account also. The time evolution of the system shows two different time scales: a slow one for the heavy particles, and a fast one for the light ones. We find an approximate dynamics for the system, and estimate the error. It turns out that, at any fixed time, such an error vanishes with the ratio between the mass of the light particles and the mass of the heavy ones. Exploiting such approximation we give a simple description of the decoherence induced by the light particles to the heavy ones.

Jean Bellissard, (Atlanta), July 8 - July 15

"Topics on the Mathematical Theory of Quantum Transport"

Abstract: "We will discuss one of the following mathematical problems in the theory of quantum transport (i) the main approximations in quantum transport theory: local equilibrium, Markov, adiabatic; Markov semigroups (ii) heuristic of linear response theory and derivation of the Greene-Kubo formula for transport coefficients, (iii) the quantum jumps models and quantum spin systems, (iv) the Levy-Khintchine formula and the Lindblad theorem: possible extensions to various categories of C*-algebras. "

Thomas Chen, (Princeton), June 1 - June 9

Coherent infrared representations and mass renormalization in non-relativistic QED

We report on recent results related to the infrared problem in non-relativistic QED. In particular, we address the problem of infrared mass renormalization, and its role in the construction of coherent infrared representations. This is in part based on collaborations with V. Bach, J. Frohlich, I.M. Sigal, and with J. Frohlich.

Michele Correggi, (ESI)

"Rapidly Rotating Bose-Einstein Condensates in Strongly Anharmonic Traps"

"We study a rotating Bose-Einstein Condensate in a strongly anharmonic trap (flat trap with a finite radius) in the framwork of 2D Gross-Pitaevskii theory. We write the coupling constant for the interactions between the gas atoms as $1/\varepsilon 2$ and we are interested in the limit $\varepsilon \to 0$ (TF limit) with the angular velocity Ω depending on ε. We derive rigorously the leading asymptotics of the ground state energy and the density profile when Ω tends to infinity as a power of $1/\varepsilon$. If $\Omega(\varepsilon) = \Omega_0/\varepsilon$ a "hole" (i.e., a region where the density becomes exponentially small as $1/\varepsilon \to \infty$) develops for Ω_0 above a certain crirtical value. If $\Omega(\varepsilon) \gg 1/\varepsilon$ the hole essentially exhausts the container and a "giant vortex" develops with the density concentrated in a thin layer at the boundary."

Stephane de Bievre (Lille), 5 days between June 1 - June 9

The Unruh effect revisited (with Marco Merkli)

Abstract: The following observation, now referred to as the Unruh effect, was made by W. Unruh in 1976. When a detector, coupled to a relativistic quantum field in its vacuum state, is uniformly accelerated through Minkowski spacetime, with proper acceleration a, it registers a *thermal* black body radiation at temperature $T = \frac{\hbar a}{2\pi c k_{\mathrm{B}}}$. This result has attracted a fair amount of attention, and generated considerable surprise and even some scepticism. We give a complete and rigorous proof of this statement, in the following form. We show that the state of a two-level system, uniformly accelerated with proper acceleration a, and coupled to a scalar bose field initially in the Minkowski vacuum state will converge, asymptotically in the detector's proper time, to the Gibbs state at inverse temperature $\beta = \frac{2\pi}{a}$. We treat the problem as one of return to equilibrium, exploiting in particular that the Minkowski vacuum is a KMS state with respect to Lorentz boosts.

Jan Dereziński (Warszawa), 1 June -5 June, and 20 July - 1 August

Homogeneous interacting Bose gas and its excitation spectrum

Abstract: The main object of my interest will be the joint energy-momentum spectrum of the Bose gas in thermodynamic limit. I will formulate some conjectures about its infimum and describe their relevance for physics of cold gases. I will describe a variational approach to the study of the excitation

spectrum of the Bose gas related to the famous Bogoliubov ansatz. This is based on a joint work with H.Cornean (Aalborg) and P.Zin (Warsaw).

"Hypergeometric type functions and their symmetries"

Abstract: By hypergeometric type functions I mean functions satisfying the equation $\sigma(z)F''(z) + \tau(z)F'(z) + \eta F(z) = 0$. They comprise the usual hypergeometric function, the confluent, classical orthogonal polynomials and (up to a simple transformation) the Bessel functions – the most often used functions of mathematical physics.

"Quadratic Hamiltonians and their renormalization"

Abstract: Hamiltonians defined by quadratic expressions in creation and annihilation operators (which I call Bogoliubov and van Hove Hamiltonians) are considered to be well understood. I will show that in the case of an infinite number of degrees of freedom they have a richer theory, than perhaps expected. They may exhibit both the infra-red and ultra-violet problem, which may lead to an infinite renormalization.

Laurent Desvillettes (Cachan), May 30 - June 2

"Large time asymptotics of the spatially inhomogeneous Aizenmann-Bak model".

Abstract: Entropy methods have been used with success in order to predict the large time asymptotics of many dissipative PDEs (nonlinear diffusions, fourth-order PDEs, reaction-diffusion systems, spatially homogeneous and spatially inhomogeneous kinetic equations involving collisions).

The main advantages of these methods are their robustness and the fact that all estimates are given with explicit constants (no compactness argument is needed).

Among the models which have been studied by entropy methods, the spatially homogeneous coagulation-fragmentation equations are one of the first for which exponential decay to equilibrium has been proven. A result of the late seventies by Aizenmann and Bak shows indeed that this decay occurs when the rates of coagulation and fragmentation are constant.

In a work in collaboration with J. Carrillo and K. Fellner, we prove that this exponential decay also holds when the spatial variable is taken into account (under the form of a diffusion). The proof that we propose is based on techniques coming from parabolic equations (of reaction-diffusion type) as well as kinetic equations.

Raffaele Esposito (L' Aquila), June 25 - July 9

"On the derivation of the Boltzmann equation from quantum mechanics"

Abstract: The evolution of quantum interacting particle system in the weak coupling limit is described by a Boltzmann equation with quantum cross section and a suitable modification to take into account the quantum statistics. In the low density limit on the other hand the limit equation is just the classical Boltzmann equation with quantum cross section. At the moment no one of the above statements has been proved for the fully non linear case (in the linear case the Erdoes-Yau results cover a large variety of situations). In the talk I shall discuss a partially successful attempt to obtain a validity proof in the non linear case starting from the Wigner hierarchy and constructing a diagrammatic expansion. This is helpful to select the "good" graphs whose sum converges to the solution of the limiting equations. Moreover the "bad" graphs are proved to vanish in the limit. The convergence of the full series is still an open problem.

Felix Finster (Regensburg), July 24/25

"A variational principle in discrete space-time"

ABSTRACT: We introduce the mathematical framework of the principle of the fermionic projector and set up a variational principle in discrete space-time. The variational principle is explained in simple examples. The connection to the continuum theory (relativistic quantum mechanics, gauge field theory) is outlined. Recent results and open problems are discussed.

Juerg Froehlich (Zuerich), June 5-June 6 and maybe second workshop "Status of the Fundamental Laws of Thermodynamics", and "Atomism and Quantization"

Irene Gamba (Texas), June 3 - June 11

Title: "Self-similar Asymptotics for generalized non-linear models of Boltzmann-Maxwell type"

abstract: We study long time dynamics to solutions of initial value problems to a rather general multi-linear Boltzmann kinetic models of Maxwell type which may describe qualitatively different processes in applications, but have many features in common. In particular we focus in the existence, uniqueness and asymptotics to self-similar (or dynamical scaling) solutions and connections to Central Limit theorems for non-Gaussian states.

We use a relationship of spectral properties of the problem in Fourier space to the existence and asymptotic behavior of the solution of the original initial value problem as well as the characterization of the domain of attraction to self-similar states. We clarify the connection with contractive measures for the pdf solution of the kinetic problem and discuss the optimal decay rates. In particular we show that the self-similar asymptotic dynamics imply that the solutions of these type of problems evolve to "infinitely divisible" process, where the tails and time decay laws are classified from the spectral properties related to the original problem.

Examples are models of Maxwell type in classical space homogeneous, elastic or inelastic Boltzmann equation, and the elastic Boltzmann equation in the presence of a thermostat, all with finite or infinite initial energy, as well as Pareto distributions models in economy, and Smoluckowski type of equations for coalescence/fragmentation problems.

This is in part a collaborative work with A. Bobylev and C. Cercignani.

Christian Hainzl (Birmingham, Alabama), May 15-August 15

"On minimization methods for relativistic spin-$\frac{1}{2}$ particles in mean-field approximation"

Abstract: We consider a first principle Hamiltonian for spin-$\frac{1}{2}$ particles, which is derived from Quantum Electrodynamics by using Coulomb gauge and neglecting photons. In spite of its unboundedness from below we succeed in giving sense to its minimizer, which in the translation invariant case is interpreted as the natural filling of the Dirac sea. In the presence of external sources we obtain the polarized vacuum as well as ground states for atoms and molecules when minimizing on charge sectors. All our results are obtained in a mean-field approximation. This is a survey of several papers.

Christian Jaekel, (Zürich), June 3- June 23

Title : The $P(\Phi)_2$ model on the de Sitter space

Abstract: We provide a self-contained construction of the model, based on a great variety of methods and results from the literature, including har-

monic analysis on symmetric spaces, group representation theory, Markov processes, Tomita-Takesaki modular theory and Osterwalder-Schrader reconstruction theorems. The thermal aspects (Hawking temperature) induced by the curvature and the the exceptional case of particles with small masses are discussed in the interacting case. We also explore the relations of the euclidean approach to the Wightman and Haag-Kastler axiomatic schemes which have been proposed foe de Sitter space recently.

OR Title: Stability and Related Properties of Vacua and Ground States

Abstract: We consider the formal non relativistc limit (nrl) of the $: \phi 4 :_{s+1}$ relativistic quantum field theory (rqft), where s is the space dimension. Following work of R. Jackiw, we show that, for $s = 2$ and a given value of the ultraviolet cutoff κ, there are two ways to perform the nrl: i.) fixing the renormalized mass $m2$ equal to the bare mass $m_0 2$; ii.) keeping the renormalized mass fixed and different from the bare mass $m_0 2$. In the (infinite-volume) two-particle sector the scattering amplitude tends to zero as $\kappa \to \infty$ in case i.) and, in case ii.), there is a bound state, indicating that the interaction potential is attractive. As a consequence, stability of matter fails for our boson system. We discuss why both alternatives do not reproduce the low-energy behaviour of the full rqft. The singular nature of the nrl is also nicely illustrated for $s = 1$ by a rigorous stability/instability result of a different nature.

Shi Jin (Wisconsin), June 1 - June 9

Title: On Hamiltonian Systems and Liouville Equations with Discontinuous Hamiltonians

We introduce solutions to Hamiltonian systems and Liouville equations with discontinuous Hamiltonians. Such problems arise in high frequency limits of linear waves through heterogeneous media, such as the semiclassical limit of Schrodinger through a barrier, or geometrical optics through sharp interfaces. We first define the physically relavant solutions via an interface condition based on transmission and reflection coefficients, and then incorporate this condition into the numerical scheme to construct efficient numerical methods for efficient computation of high frequency waves. fluxes. This method allows the resolution of high frequency waves without numerically resolving the small wave lengths, and capture the correct transmissions and reflections at the interface with a sharp numerical transition through the barrier/interface. Moreover, we extend the method to include diffraction, and quantum barriers. Applications to semiclassical limit of linear Schrodinger equation, geometrical optics, elastic waves, and semiconductor device modeling, will be discussed.

Alain Joye (Grenoble), July 17 to 21, or the next one from July 24 to 28

"Asymptotics of repeated interaction quantum systems"

A quantum system S interacts in a successive way with elements E of a chain of identical independent quantum subsystems. Each interaction lasts for a duration T and is governed by a fixed coupling between S and E. We show that the system, initially in any state close to a reference state, approaches a "repeated interaction asymptotic state" in the limit of large times. This state is T–periodic in time and does not depend on the initial state. If the reference state is chosen so that S and E are individually in equilibrium at positive temperatures, then the repeated interaction asymptotic state satisfies an average second law of thermodynamics. This is joint work with L. Bruneau and M. Merkli

Mathieu Levin (Cergy-Pontoise), May 30- June 1

TITLE: Existence of atoms and molecules in the mean-field approximation of no-photon QED.

ABSTRACT: We present recent results concerning the minimization of the Bogoliubov-Dirac-Fock energy, which is the energy of Hartree-Fock states in no-photon QED. We show the existence of a global minimizer interpreted as the vacuum, and prove the existence of minimizers in charge sectors, provided some binding conditions hold. This is joint work with Christian HAINZL (Birmingham, AL) and Eric SERE (Paris Dauphine).

Jani Lukkarinen (Munich), 5th till 30th June

Title: Kinetic limit for wave propagation in a harmonic crystal with small random mass perturbations

Abstract: In this joint work with Herbert Spohn, we study crystal dynamics in the harmonic approximation. The atomic masses are weakly disordered, in the sense that their deviation from uniformity is of the order $\varepsilon^{(}1/2)$. The dispersion relation is assumed to be an analytic Morse function, which is not a constant on any affine plane. We then prove that in the limit $\varepsilon \to 0$, the disorder averaged Wigner function on the kinetic scale, time and space of order $\varepsilon^{(} - 1)$, is governed by a linear Boltzmann equation. The Boltzmann equation can then also be used to solve the average energy transfer for the crystal dynamics in the kinetic limit.

Rossana Marra (Rome), 25 June - 9 July

Title: Interface dynamics in kinetic systems

We consider kinetic models describing two species of particles interacting via a long range repulsive potential and a) with a reservoir at fixed temperature, b) by collisions. The dynamics for the first model conserves the total masses of the two species and its sharp interface limit is described by a kind of Mullins-Sekerka motion. The second dynamics models the behaviour of a binary fluid and conserves masses, momentum and energy. In the sharp interface limit in this case the velocity field satisfies the incompressible Navier-Stokes equations together with a jump boundary condition for the pressure across the interface which, in turn, moves with a velocity given by the normal component of the velocity field.

Tadahiro Miyao, (München), July 24 - July 31

"Lowest energy states in nonrelativisitc QED: atoms and ions in motion".

Abstract Within the framework of nonrelativistic QED, we consider a single nucleus and N electrons coupled to the radiation field. Since the total momentum P is conserved, the Hamiltonian H admits a fiber decomposition with respect to P with fiber Hamiltonian $H(P)$. A stable atom, resp. ion, means that the fiber Hamiltonian $H(P)$ has an eigenvalue at the bottom of its spectrum. We establish the existence of a ground state for $H(P)$ under (i) an explicite bound on P, (ii) a binding condition, and (iii) an energy inequality. The binding condition is proven to hold for a heavy nucleus and the energy inequality for spinless electrons.

Sergey Morozov (Munich), June 1 + three weeks

Title: On the Many–Particle Brown–Ravenhall Operator

Abstract: The Brown–Ravenhall model describes many particle systems in the pseudorelativistic approach. Although well–defined and semibounded from below, the operator is nonlocal and the eigenvalue problem is not exactly solvable even in the case of one–electron atom. However, it appears that the well known results of many particle theory, such as the HVZ–theorem or the existence of infinite number of bound states for neutral or positively ionized atoms, can also be proved for this model. The crucial point in such proofs are the estimates for the commutators of the positive spectral projection of the free Dirac operator with multiplication operators in the configuration space.

Clement Mouhot, CEREMADE, May 29- June 4

Title: An overview of recent advances and perspectives for the mathematical theory of granular media

Abstract: We present in this talk an introduction to the mathematical kinetic theory of granular gases. Kinetic models of inelastic Boltzmann type are used to model granular gases in regimes such as rapid and dilute flows. Granular gases are composed of colliding macroscopic grains dissipating energy during collisions. This dissipative feature is responsible for effects such as collapse, non-maxwellian tail and self-similar behavior of the velocity distribution at the kinetic level, as well as instability and cluster formation at the hydrodynamical level. We shall present recent mathematical advances in the understanding of the phenomena as well as some perspectives. This talk shall survey several papers including in particular our joint works with Stphane Mischler and Mariano Rodriguez Ricard.

Bruno Nachtergaele (Davis), June 10 and June 28

Title: Finite speed of propagation in quantum lattice systems and applications

Abstract: We give a short proof of the Lieb-Robinson bound for a general class of quantum lattice systems and discuss several applications: an upper bound on the speed of information transmission in quantum channels, an upper bound on the propagation of correlations and entanglement, an upper bound on the correlation length in the ground state of quantum spin models in terms of the spectral gap above the ground state, and a Lieb-Schultz-Mattis Theorem in arbitrary dimensions.

Heide Narnhofer (Wien), July 24 -

"The effect of multicorrelations on entanglement"

Krzysztof Pachuki (Warszawa), July 17-31

Title:"Quantum electrodynamics of weakly bound atomic systems"

Quantum electrodynamics (QED) is the underlying theory to describe all atomic systems. I will present an approach, the effective NRQED theory, which allows for a highly accurate theoretical predictions in atomic systems. NRQED is based on simple and intuitive "physical" assumptions and on the existence of perturbative expansions in the fine structure constant α. Its predictions are verified by comparison to precise measurements.

Annalisa Panati, (Paris), July 24 - July 31

"Ground state for the massless Nelson model under binding condition"

Abstract: When considering a non-relativistic atom coupled to a quantized radiation field, it is natural to require that the model predicts the existence of a ground state. In a recent paper, Griesemer, Lieb and Loss focalized a condition under which they could prove that the Pauli Fierz model with Coulombian interactions admits a ground state in the infrared limit. Here, we consider the Nelson model with Coulombian interactions under the same condition and we show that in the infrared limit it does not admit a ground state in the Fock representation, but it does in another not unitarily equivalent g-coherent representation.

Gianluca Panati (Munich), July 23 - August 3 "Adiabatic decoupling of Quantum Dynamics"

Abstract: Separation of time scales is a fundamental tool in understanding the dynamics of both classical and quantum systems. Following this leading idea, a general mathematical theory to deal with quantum systems has been developed (space-adiabatic perturbation theory).

In the seminar I will first illustrate the main ideas of this theory in the simplest case, namely the Born-Oppenheimer approximation in molecular physics. Then I will show as similar methods can be applied to analyse the dynamics of non-interacting electrons in a perturbed periodic potential

(relating the Schroedinger equation and the celebrated "colorful Hofstadter butterfly"), to the Dirac equation and to models in semi-relativistic QED.

Based on joint works with F. Faure, H. Spohn and S. Teufel.

Alessandro Pizzo (Zuerich), June 1 - June 24, July 24- July 31

Title: "Infrared-Finite algorithms in QED"

We consider a nonrelativistic electron moving in the Coulomb field of a single nucleus of unit charge and interacting with the soft modes of the quantized electromagnetic field. Our main concern is how to rigorously control the higher order radiative corrections to the scattering amplitudes in the low energy regime (Rayleigh scattering). In fact Taylor formula is ill-defined when no infrared regularization is adopted. We develop a proper perturbation theory and we provide an asymptotic expansion up to any order in the coupling constant for the scattering amplitudes, which represents a first important step towards a rigorous analysis of metastable states. At this stage (scattering amplitudes), the asymptotic expansion of the groundstate vector of the system is the main technical issue. Concerning this expansion, we use a scaling analysis technique based on the iteration of the analytic perturbation.

Benjamin Schlein (Harvard), May 31 - June 16, July 24 - July 31

Title: On the derivation of the non-linear Schrödinger equation

Abstract: I will discuss recent results concerning the derivation of the nonlinear Schrödinger equation for the macroscopic dynamics of a system of N interacting bosons in the mean field limit. This is a joint work with L. Erdős and H.-T. Yau.

"Asymptotic completeness for Rayleigh and Compton scattering".

Abstract: I will discuss rigorous results concerning the scattering theory for models of non-relativistic matter coupled to a quantized radiation field. This talk is based upon joint works with Juerg Froehlich and Marcel Griesemer.

Robert Seiringer (Princeton), May 31 – June 12

Title: Derivation of the Gross-Pitaevskii Equation for Rotating Bose Gases

Abstract: We present a proof that the Gross-Pitaevskii (GP) equation correctly describes the ground state energy and corresponding one-particle density matrix of rotating, dilute, trapped Bose gases with repulsive two-body interactions. We also show that there is 100% Bose-Einstein condensation. While a proof that the GP equation correctly describes non-rotating or slowly rotating gases was known for some time, the rapidly rotating case was unclear mainly because the Bose (i.e., symmetric) ground state is not the lowest eigenstate of the Hamiltonian in this case. For the case of axially symmetric traps, our results show that the appearance of quantized vortices causes spontaneous symmetry breaking in the ground state. (Joint work with Elliott Lieb.)

Eric Sere, CEREMADE, July 19 - July 27 The Bogoliubov-Dirac-Fock model for molecules.

Co-authors: Christian Hainzl, Mathieu Lewin.

The Bogoliubov-Dirac-Fock (BDF) model is a mean-field approximation of no-photon QED. A ground state of the BDF energy in the charge sector -N, if it exists, can be written as a sum of two projectors. The first one, of infinite rank and charge zero, is interpreted as the Dirac sea in the BDF mean field. The second one, of rank N, represents a system of N electrons, and is solution of a system of unprojected Dirac-Fock equations, corrected by a vacuum polarization term. We prove the existence of such a ground state near a collection of fixed nuclei, in several particular situations.

Geoffrey Sewell (London), 29 May till 10 June.

Title: Construction of Quantum Models that provide a Hydrodynamic Picture of Nonequilibrium Steady States

Abstract: The purpose of this work is to bring together two different approaches to the theory of nonequilibrium steady states, as viewed on the hydrodynamic scale. The first of these [I] was based on a class of *classical* stochastic models and yielded a picture wherein the fluctuations of the hydrodynamic observables about a nonequilibrium steady state execute an Onsager-Machlup process and where their spatial correlations are of long

range. The second approach [II], which led to essentially the same results, comprised a general *quantum* macrostatistical treatment of nonequilibrium steady states, based on the assumptions of (a) a chaoticity hypothesis pertaining to the currents associated with local conserved hydrodynamical observables, (b) an extension of Onsagers regression hypothesis and (c) a certain mesoscopic local equilibrium hypothesis. The object of the present work is to construct quantum mechanical versions of the stochastic models of [I] and to show that they satisfy the assumptions (a)-(c) of [II]. This achieves the twin purposes of extending the constructive scheme of [I] to the quantum regime and of providing a realisation of the 'axiomatic' scheme of [II].

[I] L. Bertini, A. Da Sole, D. Gabrielli, G. Jona-Lasinio and C. Landim: J. Stat. Phys. **107**, 635, 2002.

[II] G. L. Sewell: Rev. Math. Phys. **17**, 977, 2005

Heinz Siedentop (Munich), July 18-22

Title: "Large atoms are non-relativistic to leading order: a quantitatively correct model"

Israel Michael Sigal (Toronto), July 3 - August 2

"Renormalization group and scattering theory of electrons and photons"

Abstract: In this talk I describe recent results on the application of the spectral renormalization group (SRG) to the scattering theory for photons and atoms. Specifically, I outline a proof (combining SRG with the Mourre estimate) of the local decay property for such scattering below the ionization threshold (Rayleigh scattering).

Christof Sparber (Wien)

Adiabatic description of piezoelectricity

As a simple model for piezoelectricity we consider a gas of infinitely many non-interacting electrons subject to a slowly time-dependent periodic potential. We show that in the adiabatic limit the macroscopic current is determined by the geometry of the Bloch bundle. As a consequence we obtain the

King-Smith and Vanderbilt formula up to errors smaller than any power of the adiabatic parameter.

Heribert Zenk (München), July 24 - July 31

"Photoelectric effect"

Abstract: In this talk I want to sketch a way, how to explain the photoelectric effect in a variant of the standard model of non relativistic quantum electrodynamics. We will specify a situation, where ionisation probability in first order is a weighted sum of single photon terms. Furthermore we will see, that Einstein's equality

$$E_{kin} = h\nu - \triangle E$$

for the maximal kinetic energy E_{kin} of the electron, energy $h\nu$ of the photon and ionisation gap $\triangle E$ is the crucial condition, for these single photon terms to be nonzero.