The programme of the School includes presentation of posters during two poster sessions (A and B), and invited seminars (S).

[Addresses in titles of posters are given for the participating author only.]

Nano-size Superconducting Constrictions in High Magnetic Fields. A1

E. BASCONES
Instituto de Ciencia de Materiales de Madrid, 28049 Cantoblanco (Madrid) Spain

We report on the measurement of multiple Andreev resonances at atomic size point contacts between two superconducting nanostructures of Pb under magnetic fields higher than the bulk critical field, where superconductivity is restricted to a mesoscopic region near the contact. The small number of conduction channels in this type of contacts permits a quantitative comparison with theory through the whole field range. We discuss in detail the physical properties of our structure, in which the normal bulk electrodes induce a proximity effect into the mesoscopic superconducting part.

Resonant Tunnelling Through Coupled Quantum Dots B1

D. BOESE
Institut fur Theoretische Festkorperphysik, Universitat Karlsruhe, 76128 Karlsruhe, Germany

We study single electron transport through two coupled quantum dots, which we can map onto a two-level dot. Using a real-time diagrammatic technique, and in the resonant tunnelling approximation, we can calculate the average-charge on the dot, the spectral function and the conductance.

Negative Magnetoresistance of Granular Metals in a Strong Magnetic Field A2

I. BELOBORODOV
Institut fur Theoretische Physik III, Ruhr-Universitat Bochum, D-44780 Bochum, Germany

The magnetoresistance of a granular superconductor in a strong magnetic field destroying the gap in each grain is considered. It is assumed that the tunnelling between grains is sufficiently large such that all conventional effects of localisation can be neglected. A non-trivial sensitivity to the magnetic field comes from superconducting fluctuations leading to the formation of virtual Cooper pairs and reducing the density of states. At low temperature, the pairs do not contribute to the macroscopic transport but their existence can drastically reduce the conductivity. Growing the magnetic field one destroys the fluctuations, which improves the metallic properties and leads to the negative magnetoresistance.

2D Dirac Fermions with Random Mass **A10**

M. BOCQUET, Didina Serban, Martin Zirnbauer
Service de Physique theorique, C.E.A., Saclay, F-91191 Gif-sur-Yvette Cedex, France.

We study the problem of N species of 2-dimensional Dirac fermions with random mass (class D symmetry). For one species the effective interaction induced by the disorder mass is known to be marginally irrelevant. The density of states for a single particle near *E=0* then behaves like $E(\ln E)^2$. We use the reduction to a non-linear sigma (NLS) model to study the low energy physics of the general case. A new scale of energy (in the form of a dynamically generated mass) appears as a substitute to a Fermi energy and allows for the construction of the NLS model. Contrary to a normal metal, the saddle point approximation used to derive the NLS model is not valid for low N. Yet in the limit of a large number of fermions, the RG physics flows to the strong coupling regime where the saddle-point approximation is valid. We compute the density of states in the ergodic limit near *E=0*, using the random matrix limit of the NLS model. Because the particles are Dirac fermions, we are able to extend the usual gradient expansion of the NLS model and obtain a topological term, without additional parameter. We also consider a network model, through its effective super-spin chain, which is a discrete realisation of the symmetry class D, as an alternative derivation of the NLS model.

Plasmon and Charge Quantization in a Double Barrier Quantum Wires **B2**

A. BRAGGIO
Universita di Genova, Via Dodecaneso, 33, 16167 Genova, Italy

We investigate nonlinear transport properties of correlated quasi-one dimensional electron systems in the presence of two impurities. Using the Luttinger liquid model we discuss the microscopic nature of Coulomb oscillations, the Coulomb staircase phenomena and the influence of electron-electron interaction on these properties.

Extraordinary Hall Effect (EHE) in Magnetic Multilayers **B17**

A. CREPIEUX
Max-Planck-Institut fuer Mikrostrukturphysik, Halle, Germany

Magnetic multilayers exhibit interesting properties, particularly the GMR. Recently, experimental works have shown an unusual behaviour of the EHE in such systems. However, few theoretical works are about this effect. We report on the numerical calculations to determine the electrical and the extraordinary Hall resistivities taking the spin-orbit coupling into account. We apply the coherent potential approximation to treat disorder in both bulk and multilayer systems and use the Kubo formalism to calculate the conductivity tensor.

Frequency Scaling and Mode Locking of Photo-Induced Tunnelling **B25**

G. CUNIBERTI
Max-Planck-Institut fur Physik Komplexer Systeme, Dresden

We investigate the non-linear ac transport trough a quantum wire with an impurity in the presence of finite range electron-electron interactions. I discuss the influence of the spatial shape of the ac electric field onto transport properties of the system and find that the

scaling behaviour of the occupation probability of the side-bands depends on the range of the voltage drop. We observe a cross-over between the Tien-Gordon like scaling of the side-bands and a regime in which the scaling reflects the ranges of both, the electron-electron interaction and the electric field. Moreover, for intermediate interaction strengths, the non-linear differential conductance shows cusp-like periodic minima due to finite non-zero range of the interaction but are independent of the shape of the driving electric field.

Optical Conductivity in $(TMTSF)_2X$ Salts: A Low Energy Effective Field Theory B11

D. CONTROZZI, F. Essler and A. Tsvelik,
Theoretical Physics, Department of Physics, University of Oxford

Recent experimental results on $(TMTSF)_2X$ have shown an interesting finite-frequency behaviour of the optical conductivity [A.Schwartz, *et al*, Phys Rev B 58,1261 (1998)]. It was argued that this behaviour is characteristic of a quasi one-dimensional half or quarter filled band with strong Coulomb correlations. An effective model to describe this physical situation is the sine-Gordon model. We perform an exact calculation of the optical conductivity in the framework of the sine-Gordon description. The results are in good agreement with experiments.

Exotic States in Quantum Dots B10

C.E. CREFFIELD, W. Haussler, R. Egger, H. Grabert, J.H. Jefferson, B. Reusch, S. Sarkar
Dpto. Teoria de la Materia Condensada, Instituto de Ciencia de Materiales de Madrid, Cantoblanco, E-28049, Madrid, Spain

Different approaches to calculate low energy properties in quantum dots will be assembled and compared, including exact diagonalizations, effective charge-spin descriptions, Quantum Monte Carlo methods (circumventing the Fermion sign problem), and mean field descriptions in their strengths and weaknesses.

Application of the Sine-Gordon model to quasi one-dimensional quantum magnets S

F.H.L. ESSLER,
Department of Theoretical Physics, Oxford University, Oxford, UK

We discuss applications of the sine-Gordon model to quasi-1D magnetic insulators.

R-Matrix Formalism in the Finite Element Basis A11

P. FEHER
Institute of Physics, Czech Academy of Sciences, Cukrovarnicka 10, 16253 Praha, Czech Republic

We formulated scattering theory for a tight-binding Hamiltonian describing open systems in two-dimensions. R-matrix formalism was used to obtain exact scattering wave functions and transmission coefficients within the space defined by the used Hamiltonian. This method has been applied to study topologically induced circulating currents in devices formed by the straight wire with attached cavity.

NMR Determination of the Spin Polarisation of the 2D Electron Gas at Landau Levels

N. FREYTAG **A23**
Grenoble High Magnetic Field Laboratory, MPI-FKF, Grenoble, France

A 'standard' NMR spin-echo technique has been used to observe the 69, 71Ga spectra in GaAs/AlGaAs multiple-quantum-well heterostructures and determine the spin polarisation (P) of the two-dimensional electron gas (2DEG) from the hyperfine shift of nuclei in quantum wells. Here we focus on the temperature ($50mK \leq T \leq 10K$) and magnetic field ($7T \leq B \leq 17T$) dependencies of P at Landau level filing factor ν = ½. The results indicate that a threshold magnetic field is required for observation of a fully polarised 2DEG at ν = ½ as T→ 0 and are discussed within the framework of composite fermion picture in terms of an effective polarisation mass.

Field Distribution in Surface Corrugated Waveguides **A12**

A. GARCIA-MARTIN, J.J. Saenz, M. Nieto-Vesperinas
Departamento de Fisica de la Materia Condensada, Universidad Autonoma de Madrid, E-28049 Madrid, SPAIN

An extensive analysis of statistical properties of the transmitted field in surface disordered waveguides is presented. Clear deviations from the Gaussian statistics are found even in the diffusive regime. The field distributions are found to be highly mode dependent. When the speckle contrast is 1, our results are in good agreement with recent experimental results by Chabanov and Genack: the intensity distribution follows the predictions of the random-phasor-sum model, even though the field phase is not uniformly distributed.

Conductance of the Single Electron Transistor in the Strong Tunnelling Regime **B3**

G. GOEPPERT, B. Huepper, and H. Grabert
Fakultat fur Physik, Albert-Ludwigs-Universitat, D-79104 Freiburg, Germany

The conductance of the single electron transistor is examined in the strong tunnelling regime, where the tunnelling conductance of the junctions may exceed the conductance quantum. Electron tunnelling is treated non-perturbatively by means of a path integral formulation and the conductance is obtained from the Kubo formula. Higher order perturbative results for weak tunnelling and analytical results for strong tunnelling based on the semiclassical approximation are bridged by quantum Monte Carlo simulations. The findings are compared with recent experimental results.

Current Density and Dissipation in Modulated 2DES at High Magnetic Fields **A24**

J. GROSS
Max-Planck-Institut fur Festkorperforschung, Stuttgart, Germany

Breakdown currents of the quantum Hall effect in two-dimensional electron systems containing an array of anti-dots were found to scale linearly with the sample widths. Therefore, we apply a local Drude type model with Hall angle of approx. 90 degrees to calculate using the continuity equation, for a given average current, the current density and the potential. We find that, with increasing Hall angle, the current density is increasingly expelled from the regions occupied by the anti-dots, and twisted vortex structures evolve around the anti-dots. From the distribution of hot spots and cold regions in the anti-dot array we can understand many of the recent experimental results.

Correlation in Quantum Dots **S**

W. HAUSSLER
I Institut fur Theoretische Physik der Universitat Hamburg, Jungiusstrasse, D-20355 Hamburg, Germany

For weak interactions or high carrier densities the electronic states in artificial atoms can be described by effective single particle orbitals, similar as in the natural counterparts. However, parameters such as the carrier density or the geometry can be tuned deliberately to achieve even qualitatively new situations. I will review this crossover into the strongly correlated regime, also regarding consequences for the transport properties, and give a theoretical description in terms of effective charge-spin models.

Shuttle Instability in Self-Assembled Coulomb Blockade Nanostructures **B4**

A. ISACSSON
Department of Applied Physics, Chalmers University of Technology, S-412 96 Gothenburg, Sweden

A simple model of a self-assembled Coulomb Blockade nanostructure containing a metallic nanocrystal or grain connected by soft molecular links to two metallic electrodes is here shown to exhibit self-excitation of periodic grain vibrations for sufficiently large bias voltages. This induces a mechanically transferred current characterized by non-linear and hysteretic I-V characteristics.

The Capacity of a Double Barrier in a Quantum Wire **B5**

T. KLEIMANN, M. Sassetti, Bernhard Kramer
DIFI, Universita di Genova, Via Dodecaneso 33, 16167 Genova, Italy

We model a one-dimensional quantum dot by a double barrier in a quantum wire, and present a microscopic description of the capacity of the island in terms of Luttinger liquid theory. The capacity arises due to long-range interactions between the electrons and is not put phenomenologically as usually. The behaviour of the capacity is examined with respect to the interaction range and island length.

Two-scale Localisation in Disordered Wires in a Magnetic Field **A13**

A. KOLESNIKOV
Institut fur Theoretische Physik III, Ruhr-Universitat Bochum, D-44780 Bochum, Germany

Within the super-symmetry technique, we show that the tail of wave functions decays at arbitrarily weak magnetic field with the length twice as large as that of at shorter distances. The crossover between the orthogonal and unitary ensembles in disordered wires is characterised by two temperature regimes in the hopping conductivity

Minibands, Magnetic Breakdown, and Novel Magnetoresistance Oscillations in Short-Period Lateral Superlattices **A25**

M. LANGENBUCH, R. Hennig, M. Suhrke, U. Roessler, C. Albrecht, J.H. Smet, D. Weiss
Institut fur Theoretische Physik, Universitat Regensburg, 93040 Regensburg, Germany

Novel 1/B periodic low-field oscillations observed in the magneto-resistance of short-period lateral superlattices with weak electrostatic modulation are analysed as being due to the formation of mini-bands. The weak superlattice potential distorts the Fermi circle of the non-modulated two-dimensional electron system (2DES) and smaller closed Fermi contours appear, which leads to the novel oscillations.

Non-linear Conductivity and Quantum Interference in Disordered Metals **A14**

M. LEADBEATER, R. Raimondi, P. Schwab and C. Castellani
Dipartimento di Fisica, Universita di Roma III, Via della Vasca Navale 84, 00146, Roma

We present a novel non-linear electric field effect in the conductivity of disordered conductors. We find that an electric field gives rise to de-phasing in the particle-hole channel, which depresses the interference effects due to disorder and interaction and leads to a non-linear conductivity. This non-linear effect introduces a field dependent temperature scale T_E and provides a microscopic mechanism for electric field scaling.

Topological Phenomena in Normal Metals **B23**

A. MALTSEV
SISSA-ISAS Trieste, Italy

It is shown that the observation of conductivity in normal metals in the presence of a strong magnetic field can reveal such non-trivial topological characteristics of Fermi surface as integral planes, connected with the conductivity tensor and locally stable under small rotations of the magnetic field. Such a situation corresponds to the existence of generic open quasi-classical electron trajectories on the Fermi surface. Besides that we discuss the contribution to the conductivity tensor of non-generic ergodic electron trajectories, which can exist on the Fermi level for some special direction of magnetic field.

Quantum Wires as Luttinger Liquids **B6**

E. MARIANI
Institut fur Theoretische Physik, Universitat Hamburg, Jungiusstrasse 9, D-20355 Hamburg, Germany

In this work I consider the Resonant Raman Scattering on Quantum Wires treated as two band Luttinger liquids and interpret the structures in the cross section in terms of Collective Excitations. In the resonant regime I obtain a violation of the selection rule connecting the relative polarisation of the photons with the charge or spin modes of the system. A new selection rule emerges: Near the resonance, only modes with a positive group velocity give rise to sharp peaks in the cross section. I find a good agreement with the experimental data of Raman spectroscopy on quantum wires and show that the Luttinger model is a suitable tool to interpret the behaviour of 1D system of interacting electrons.

Tunnelling Spectroscopy with 2D Electron Gases **B24**

J.S. MEYER, A. Altland, M. Janssen,
Institut fur Theoretische Physik III, Ruhr-Universitat Bochum, D-44780 Bochum, Germany

A novel approach to the investigation of spatial correlations in two-dimensional electron gases (2DEGs) is proposed. We present a non-destructive method for measuring local structures by tunnelling spectroscopy with parallel 2DEGs in a weak, in-plane magnetic field. While previous works concentrated on the average current, which is determined by the mean free path, the analysis of the current fluctuations admits for resolving long-ranged correlations. We show that the Fourier spectrum of the current fluctuations has a simple product structure, making it possible to investigate the properties of the 2DEGs separately.

Radiative Transfer Theory for Fluctuations in Disordered Optical Systems **A15**

E.G. MISHCHENKO, C.W.J. Beenakker
Instituut-Lorentz, Universiteit Leiden, Leiden, NL & Landau Institute for Theoretical Physics, Moscow, Russia

A semiclassical kinetic theory is presented for the fluctuations of photon density and current in disordered optical systems. Vacuum fluctuations of the electromagnetic field are considered as the source of photo-current fluctuations together with the fluctuations due to photon scattering. The kinetic theory in the diffusion approximation is applied to the super-Poissonian noise, due to photon bunching and to the excess noise due to beating of incident radiation with the vacuum fluctuations.

Ground States for Gadolinium Titanate: Classical Dipolar and Exchange Interactions on a Geometrically Frustrated Lattice **B12**

S.E. PALMER, J.T. Chalker
University of Oxford, Department of Theoretical Physics, 1 Keble Road, Oxford OX1 3NP.

We study geometrically frustrated antiferromagnets with nearest-neighbour exchange interactions. This system exhibits a highly degenerate ground state manifold and we study how long range dipole-dipole interactions completely lift this degeneracy. This work applies in particular to the pyrochlore compound $Gd_2Ti_2O_7$.

Kosterlitz-Thouless vs Ginzburg-Landau description of 2D superconducting fluctuations **B19**

A. PERALI, L. Benfatto, C. Castellani, C. Di Castro, M. Grilli
Dipartimento di Fisica, Universita'di Roma "La Sapienza", Piazale Aldo Moro 2, 00185 – Roma, Italy

We evaluate the charge and spin susceptibilities of the 2D attractive Hubbard model and we compare our results with Montecarlo simulations on the same model. We discuss the possibility to include topological Kosterlitz-Thouless superconducting fluctuations in a standard perturbative approach substituting in the fluctuation propagator the Ginzburg-Landau correlation length with the Kosterlitz-Thouless correlation length.

Electron-phonon interaction in copper-oxide planes **B13**

P. PIEKARZ
Jagellonian University, Marian Smoluchowski Institute of Physics, Poland

Using a three-band model of copper-oxide planes with the electron-phonon interaction, we study phonon-induced effective interactions between charge carriers. We have shown that two important phonon modes, namely, the breathing and buckling modes, may contribute to a pairing mechanism. We have demonstrated that a crucial role in the attractive interaction, induced by the breathing mode, is played by electron correlations on copper ions.

Proximity Effect in Planar Superconductor / Semiconductor Junction **A3**

D. QUIRION, F. Lefloch, M. Sanquer
DRFMC-SPSMS, CEA/Grenoble 17, avenue des Martyrs, 38054 Grenoble cedex 09 France

We have measured the very low temperature (down to 30mK) sub-gap resistance of titanium nitride/highly doped silicon SIN junction. As, the temperature is lowered below the gap, the resistance increases as expected in SIN junction. Around 250mK, the resistance shows a maximum and decreases at lower temperature. This observed behaviour is due to the coherent back-scattering towards the interface by disorder in silicon ('reflection-less tunnelling'). This effect is also observed in the voltage dependence of the resistance (zero-bias anomaly) At low temperature (T<300mK). The overall behaviour (in both its temperature and voltage dependence) is compared to existing theories and values for the de-pairing rate, the barrier resistance and the effective carrier temperature are extracted.

Finite-Temperature Transport in Finite-Size Hubbard Rings in the Strong-Coupling Limit **B14**

N.M.R. PERES, R.G. Dias, P.D. Sacramento, J.M.P. Carmelo
Departamento de Fisica, Universidade d'Evora, Rua Romao Ramalho, 59,
P-7001-709, Evora Codex, Portugal

We study the current, the curvature of levels, and the finite temperature charge stiffness, *D(T,L),* in the strongly correlated limit, *U*>>t, for Hubbard rings of *L* sites, with *U* the on-site Coulomb repulsion and t the hopping integral. Our study is done for finite-size systems and any band filling. We find that, in the $U=\infty$ case, the finite-temperature charge stiffness is finite for electronic densities, n, smaller than one. Up to order *t*, the Mott-Hubbard gap is $\Delta = U - 4t$, and we find that *D(T)* is finite for *n<1*, but is zero at half-filling. This result comes from the effective flux felt by the holon excitations, which, due to the presence of doubly occupied sites, is renormalized to $\Phi = j\,(N_h - N_d)/(N_h + N_d)$, and which is zero at half-filling. Further, for half-filling, the current transported by any eigenstate of the system is zero and, therefore, *D(T)* is also zero.

Magnetoresistance of Two Dimensional Electron Gas in the Presence of Spin-Orbit Scattering **A16**

A. PUNNOOSE, A.M. Finkelstein
Department of Condensed Matter Physics, Weizmann Institute of Science, Rehovot 76100, Israel

Electrons diffusing in a two dimensional system are studied in the presence of a uniform spin-orbit splitting of the spectrum. Weak localisation corrections to the conductivity taking into account the interplay of spin-orbit and Zeeman splitting are presented. Finally, the effects of parallel and perpendicular magnetic fields on the conductivity are discussed.

Effect of De-confinement on Resonant Transport in Quantum Wires **A17**

T. REJEC
Institut Jozef Stefan, Jamova 39, 1000 Ljubljana, Slovenia

The effect of de-confinement due to finite band offsets on transport through quantum wires is investigated. One-electron and two-electron solutions of the scattering problem for various wire shapes and dimensions are presented.

Neutral Excitons and Charged Excitons in Quantum Wells **B21**

C. RIVA, K. Varga and F.M. Peeters
Universiteit Antwerpens (UIA) Dept. Nat., Universiteitsplein 1, B-2610 Antwerp, Belgium

We present a variational study of the energy levels of excitons and charged excitons in a quantum well system. We use the stochastic variational technique to solve the complete Hamiltonian of the system. We calculate the energy spectra for an exciton and a charged exciton in a quantum well. We study its dependence on the well width and on the ratio between the electron and the hole mass. The comparison with the experiment is very good both for the exciton and for the charged exciton. The correlation functions of the electron-hole and of the electron-electron pairs are also investigated.

Quantum Chaos on the Hyperbolic Plane **B20**

S. ROBERTS
Department of Physics, Bristol University, Bristol, UK

The classical and quantum dynamics for free motion on surfaces of constant negative curvature are studied. Connections between the eigenvalues and eigenfunctions of the Louiville operator for the classical motion and the energy levels and eigenstates for the quantal version of this problem are established.

Quantum Transport in Magnetic Hybrid Nanostructures **B15**

S. SANVITO, C.J. Lambert, J.H. Jefferson
School of Physics and Chemistry, Lancaster University LA1 4YB, Lancaster UK,
and DERA, Electronics Sector, Malvern, Worcs. WR14 3PS, UK

Technological advances in nano-fabrication has enabled a variety of novel magnetic structures to be made. The extremely reduced dimensions require a quantum approach to transport, going beyond the diffusion equation. In this contribution I will present a very general numerical technique to compute quantum transport of heterostructures, which uses both accurate *spd* tight-binding Hamiltonians and simpler models. I will apply this technique to CPP GMR in magnetic multilayers, disordered magnetic systems, magnetic tunnelling junctions and superconducting/magnetic multilayer structures. The dependence of the transport on the materials, the relevant length scales, the effects of disorder and the results of having superconducting contacts will be presented. Moreover a complete picture of the spin-polarisation of the current in the different structures will be given.

Vortices in Quantum Spin Systems **B18**

J. SCHLIEMANN and Franz G. Mertens,
Physikalisches Institut, Universitat Bayreuth, D-95440 Bayreuth, Germany

We examine spin vortices in ferromagnetic quantum Heisenberg models with planar anisotropy on two-dimensional lattices. The symmetry properties and the time evolution of vortices built up from spin-coherent states are studied in detail. Although these states show a dispersion typical for wave packets, important features of classical vortices are conserved. Moreover, the results on symmetry properties provide a construction scheme for vortex-like excitations from exact eigenstates, which have a well-controlled time evolution. Our approach works for arbitrary spin length both on triangular and square lattices.

Quantum-limited linewidth of a chaotic laser cavity **A18**

H. SCHOMERUS
Institut-Lorentz, Universiteit Leiden, Postbus 9506, 2300 RA Leiden, The Netherlands

A random-matrix theory is presented for the linewidth of a laser cavity in which the radiation is scattered chaotically. The linewidth is enhanced above the Schawlow-Townes value by the Petermann factor K. We compute the mean K at the laser threshold and find that it becomes large with increasing number of channels. For one channel the distribution of K is computed as well.

Range of the Interactions and spectral statistics **B7**

F. SELVA
DSM/DRECAM/SPEC, CEA Saclay, 91191 GIF-surYVETTE, Cedex, France

We study spectral statistics and interaction matrix elements for two spinless fermions in a 1D ring, for diferent ranges of the interactions.

Persistent Current in a Wigner crystal **B7'**

F. SELVA
DSM/DRECAM/SPEC, CEA Saclay, 91191 GIF-surYVETTE, Cedex, France

Within models of spin-less fermions on a lattice, we study the persistent current at strong interaction in 2D mesoscopic rings with on site disorder.

Keldysh Action for Disordered Superconductors **A4**

M.A. SKVORTSOV, M.V. Fiegel'man, A.I. Larkin
Landau Institute for Theoretical Physics, Moscow 117940, Russia

Keldysh representation of the functional integral for the interacting electron system with disorder is used to derive microscopically an effective action for dirty superconductors. We show that this approach reproduces, without the use of the replica trick, the well-known result for the Coulomb-induced renormalization of the electron-electron coupling constant in the Cooper channel. Turning to the new results, we calculate the effects of the coulomb interaction upon: 1. the subgap Andreev conductance between superconductor and 2D dirty normal metal, and 2. The Josephson proximity coupling between superconductive islands via such a metal. These quantities are shown to be strongly suppressed by the Coulomb interaction at sufficiently low temperatures due to both zero-bias anomaly in the density of states and disorder-enhanced repulsion in the Cooper channel.

Correlation induced optimisation of the single particle wave function: Application to small systems and low-dimensional systems **S**

J. SPALEK
Institute of Physics, Jagellonian University, ulica Reymonta 4, 30-059 Krakow, Poland

Factorizable Ground States in a SO(5)-Symmetric Ladder Model **B16**

M. STAHSLMEIER and H. Frahm
Institut fuer Theoretische Physik, Universitaet Hannover, D-30167 Hannover, Germany

We introduce a family of manifestly SO(5) symmetric, finitely correlated (matrix product) quantum states. The strong coupling phase diagram of a SO(5) symmetric electronic ladder model, recently introduced by Scalapino, Zhang and Hanke [Phys.Rev. B 58 (1998), 443] is reproduced using these states as a variational ansatz. Furthermore, we construct Hamiltonians for electronic ladder models which have these states as their exact ground states. In these states, which generalise similar constructions for spin chains and ladders, we compute correlation functions.

Friedel Phases and Phases of Transmission Amplitudes in Quantum Scattering Systems **A19**

T. TANUGUCHI
Department de Physique Theorique, Universite de Geneve, Quai Ernest-Ansermet 24, CH-1211 Geneve 4, Switzerland

We illustrate the relation between the scattering phase appearing in the Friedel sum rule and the phase of the transmission amplitude for quantum scatterers connected to two one-dimensional leads. Transmission zero points cause abrupt phase changes $\pm p$ of the phase of the transmission amplitude. In contrast the Friedel phase is a continuous function of energy. We investigate these scattering phases for simple scattering problems and illustrate the behaviour of these models by following the path of the transmission amplitude in the complex plane as a function of energy. We verify the Friedel sum rule for these models by direct calculation of the scattering phases and by direct calculation of the density of states.

Superfluid Flow Past an Array of Scatterers **A7**

D. TARAS-SEMCHUCK, J.M.F. Gunn
Theoretische Physik III, Ruhr-Universitat Bochum, 44780 Bochum, Germany

We consider a model of superfluid flow past a periodic array of point-like scatterers in one dimension. We find a rich dependence of the critical current on both the scatterer strength and separation. In particular, in the case of attractive impurities, the critical current at any separation vanishes entirely at some critical scatterer strength. We describe an experimental application of this model as a Josephson array close to its critical temperature and in the presence of an electron-electron interaction. We also suggest an interpretation of the result of a zero critical current in terms of a non-linear mapping from the Ginzburg-Landau to the sine-Gordon equation.

Wigner Time Delay Distribution for One-Dimensional Random Potentials **A20**

C. TEXIER
LPTMS, Universite Paris-sud, F-91405 Orsay, Cedex, France

The distribution of the time delay for one-dimensional random potentials is universal in the high energy or weak disorder limit. The analytical results are in excellent agreement with extensive numerical simulations. We also provide a physical argument, which explains in a quantitative way the origin of the exponential divergence of the moments.

Positive and negative Hanbury-Brown and Twiss correlations in normal metal and superconducting devices. **A5**

J. TORRES
Centre de Physique Theorique, Lumimy Case 907, F-13288 Marseille, Cedex 9, France

Recent experiments on the analogue to Hanbury-Brown and Twiss devices for fermions reported negative current noise correlations, which are the consequence of an exclusion principle. Here we add a superconductor to a such system, and we show that positive (bosonic) correlations may exist in the Andreev regime.

Quantum Localised Levels in Superconducting SNI(F)NS-Structures **A6**

S. TRETYAK and Igor I. Falko
Kharkov Polytechnical University, Kharkov, Ukraine

We calculate the spectrum of excitations of a SNI(F)NS superlattice (S is a superconductor, I(F) is a ferromagnetic insulator, N is a normal metal). The of quasi-particle states exhibits a set of narrow Bloch bands lying in the middle of the energy gap of a superlattice. These Bloch bands have the width which rapidly oscillates as a function of a thickness of a superconducting layer.

Theory of De-phasing by External Perturbation in Open Quantum Dots **B8**

M.G. VAVILOV
Princeton University, Princeton, USA

We propose a random matrix theory describing the influence of a time dependent external field on the average magnetoresistance of open quantum dots. The effect of the perturbation is taken into account in all orders of perturbation theory, and the result is applicable to both weak and strong external fields.

Accuracy of a Mechanical Single Electron Shuttle **B9**

C. WEISS, W. Zwerger
Sektion Physik, University of Munich, Theresienstr. 37, D-80333 Munchen, Germany

Motivated by recent experiments, we calculate both the average current and the current fluctuations for a metallic island, which oscillates between two symmetric electrodes Electrons can only tunnel on or off the island when it is close to one of the electrodes. Using a Master equation we investigate the accuracy of such an electron shuttle both analytically and numerically. It is shown that optimum operation is reached when the contact time is much larger than the RC-time.

Can Semiclassics Explain the Random Matrix Behaviour of Quantum Chaotic Level Statistics? **B22**

R.S. WHITNEY, I.V. Lerner, R.A. Smith
School of Physics and Astronomy, University of Birmingham, Birmingham, B15 2TT, England

The study of quantum chaos level statistics in the semiclassical limit usually relies upon the Berry diagonal approximation of the Gutzwiller trace formula. It is well known that this does not reproduce the expected random matrix level statistics. We go beyond the diagonal approximation using a semiclassical method analogous to the field theory loop-expansion for disordered systems. Despite initial success, this semiclassical method cannot correctly reproduce the small regions where the classical paths "interact" with each other.

Ballistic Weak Localisation in Antidots Array **A21**

O. YEVTUSHENKO
Max-Planck-Institut fur Physik komplexer Systeme, Dresden, Germany

Weak localisation (WL) of electrons in a 2D ballistic classically chaotic billiard of anti-dots is studied. In addition to the transport relaxation and phase-coherence times, ballistic WL may be influenced by the Ehrenfest and by the Lyapunov exponent of the classical system. This results in a non-trivial temperature and field dependence of the quantum WL correction to the classical magnetoconductivity.

Positive Magnetoresistance of Composite Fermion Systems with a Weak One-Dimensional Density Modulation **A22**

S.D.M. ZWERSCHKE, R.R. Gerhardts
Max-Planck-Institut fur Festkoerperforschung, Heisenbergstrasse 1, D-70569 Stuttgart, Germany

Adopting the mean-field composite fermion picture, we describe the magneto-transport properties around filling factor 1/2 of a two-dimensional electron gas with a weak one-dimensional density modulation. The occurrence of a strong positive magnetoresistance at low effective magnetic fields as well as Weiss oscillations, which were observed in recent experiments in such systems [J. Smet et al. PRL 80, 4538 (1998)], can be explained within a semiclassical Boltzmann equation approach, provided one goes beyond the second order approximation in the modulation strength.

Weak localisation correction to the FS interface resistance **A8**

E. McCANN, V.Falko, A.Volkov, C.Lambert
Department of Physics, Lancaster University, Lancaster, UK

The resistance of a contact between ferromagnet and superconductor acquires an additional contact term, as compared to the contact between ferromagnetic and normal metals. This results from the necessity to match spin-polarised current in a ferromagnet to the spin-less current in the superconductor, which results in the accumulation of non-equilibrium polarisation near the F/S interface. In the present work, we analyse the weak localisation correction to the contact F/S resistance.