Session 25aD

Enhanced superconductivity near the metal-insulator transition **25aD1**

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It has been known for a long time that many systems, including disordered metals and metallic oxides, undergo a metal/insulator transition (MIT). We have found that the superconducting transition temperature, Tc, of such materials is enhanced in the vicinity of the MIT. We have constructed superconductivity phase diagrams (Tc vs s, the conductivity) for many materials whose only common feature is their proximity to the MIT and found that they are remarkably similar. These results suggest that there is a common mechanism for the enhancement of superconductivity near the MIT. Accordingly, we developed a simple, heuristic model to account for the observed features which is based on scaling theory near the MIT.

A theory of metallic conductivity of the two dimensional electron gas. **25aD2**

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It is well known that electron-electron interaction in two dimensional disordered systems leads to logarithmically divergent Altshuler-Aronov corrections to conductivity at low temperatures ($T\tau \ll 1$; τ is the elastic mean-free time). This work is devoted to the fate of such corrections at intermediate temperatures $T\tau > 1$. We show that in this (ballistic) regime the temperature dependence of conductivity is still governed by the same physical processes as the Altshuler-Aronov corrections - electron scattering by Friedel oscillations. However, in this regime the correction is linear in temperature; the value and even the *sign* of the slope depends on the strength of electron-electron interaction (this sign change may be relevant for the "metal-insulator" transition observed recently).

25aD3 The Density of States N(E) in the Quantum Critical Regime (QCR)

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We have determined N(E) of $a-Gd_xSi_{1-x}$ deep in the QCR.[1] $a-Gd_xSi_{1-x}$ shows a strong negative magnetoresistance for $T < 50K$ and can be tuned through the Metal-Insulator Transition by varying the magnetic field $h = H - H_C$. We observe a continuous transition from a strong Coulomb correlation regime (N(E)$\sim$N(0)+$N_1E^{1/2}$) to a soft Coulomb gap regime (N(E)$\sim E^2$). In the QCR, N(0) approximately scales with $\sigma_0^2 = \sigma^2(T = 0)$. Hall Effect measurements show that the carrier concentration vanishes linearly with h at the critical point. Spin-polarized tunneling measurements indicate a carrier polarization $p \sim 0.1$ in the QCR. We will present our results and relate them to scaling arguments.

[1]W. Teizer et al., Phys. Rev. Lett. **85**, 848 (2000) and in preparation.

25aD4 Resistance Noise Near the Metal-Insulator Transition in Si MOSFETs

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Studies of low-frequency resistance noise in Si MOSFETs demonstrate that the dramatic increase of the noise power in the insulating phase corresponds to the formation of an electron glass. The behavior of the second spectrum, a powerful higher order noise statistic, indicates the presence of long-range correlations between fluctuators in the glassy phase, consistent with the hierarchical picture of glassy dynamics. In the metallic phase, noise power is density independent. However, when parallel magnetic field is applied, despite positive magnetoresistance, noise power first decreases with increasing magnetic field, and then increases strongly near the critical field B_c for the magnetic field-driven metal-insulator transition. This behavior is discussed in the context of electron and spin glass formation.