

## Residual conductance fluctuations of tiny disordered conductors

B L ALTSHULER, D E KHMEL'NITSKII and B Z SPIVAK

Leningrad Nuclear Physics Institute, Solid State Physics Institute, Institute of Analytical Instrumentation, USSR Academy of Sciences, Leningrad, USSR

**Abstract.** Conductances of the equivalent samples differ randomly (Stone 1985). At zero temperature these fluctuations were found to be of the order of  $e^2/h$  for samples of arbitrary size and form (Altshuler 1985; Lee and Stone 1985). Experimentally such fluctuations manifest themselves as e.g. the reproducible aperiodic oscillations of the given sample conductance in magnetic field (Webb *et al* 1985; Stone 1985). These oscillations can be understood in terms of the correlation function (Lee and Stone 1985; Altshuler and Khmel'nitskii 1985) of the conductances in different fields. The characteristic field scale of the aperiodic oscillations corresponds to the unit magnetic flux through the sample.

Conductance fluctuations decrease with the growth of temperature if the sample size is larger than the diffusion length within the time  $\hbar/T$  (Stone 1985; Lee and Stone 1985; Webb *et al* 1984, 1985; Altshuler and Khmel'nitskii 1985). These fluctuations are proportional to  $T^{-1/4}$ ,  $T^{-1/2} \log T$ , and  $T^{-1/2}$  in the 3-d, 2-d and 1-d cases, respectively (Altshuler and Khmel'nitskii 1985) (the experiments of Webb *et al* 1984, 1985 correspond to the latter case).

Random potential in tiny samples breaks all space symmetries. All effects which are forbidden in the average by these symmetries should manifest themselves by (i) conductance anisotropy, (ii) its dependence on the electric field direction and (iii) giant generation of the second harmonic in the granular sample under light radiation (Altshuler and Khmel'nitskii 1985).

Conductance changes aperiodically with variation of the chemical potential (Lee and Stone 1985). Because of this thermopower fluctuations are much larger than its average value (Altshuler and Khmel'nitskii 1985).

Conductance fluctuations are very sensitive to the random impurity potential variations (Altshuler and Spivak 1985). For instance, the change of the film conductance due to the shift of *one* impurity is *finite* for any film size. This effect can be used for the super flow impurity diffusion investigations. Variations of the localized spins realization in spin glasses change the conductance. This can explain (Altshuler and Spivak 1985) the conductance dependence on the magnetic field direction observed by Webb *et al* (1984, 1985).

**Keywords.** Residual conductance fluctuations; disordered conductors.

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