THERMOPOWER MEASUREMENTS ON THE TWO-DIMENSIONAL ELECTRON GAS OF GaAs-$Al_xGa_{1-x}As$ HETEROSTRUCTURES

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Thermopower measurements on GaAs-$Al_xGa_{1-x}As$ heterostructures show that the Seebeck coefficient a_{xx} oscillates as a function of magnetic field with peak values a_{xx}^{max} at half filled Landau levels.

Thermomagnetic coefficients of a two-dimensional system in strong magnetic fields have been calculated by different authors [1,2], but experimental data are not published. In this paper we present preliminary data of thermopower measurements on GaAs-$Al_xGa_{1-x}As$ heterostructures in high magnetic fields.

The experimental set-up used for our thermopower measurements is shown in fig. 1. The GaAs-$Al_xGa_{1-x}As$ heterostructures with standard Hall geometry and a typical overall length of 7 mm are located within an evacuated sample holder in the center of a superconducting coil. A temperature gradient in the direction of the long axis of the device is obtained by connecting the device to an electric heater and to a heat sink (bath temperature T_B) as shown in fig. 1. The temperature difference ΔT between the potential probes is measured with AuFe-chrome1 thermocouples, and values up to $\Delta T = 0.2$ K are realized. The estimated uncertainty in ΔT is about 0.01 K. The thermal voltages parallel and perpendicular to the temperature gradient are measured with a resolution of + 20 nV.

Three different devices were investigated with the following carrier densities n_s, and mobilities μ:

Sample 5185 A: $n_s = 6.6 \times 10^{11}$ cm^{-2}; $\mu = 107000$ cm^{-2}/V · s;

Sample 4084 E: $n_s = 3.7 \times 10^{11}$ cm^{-2}; $\mu = 41000$ cm^{-2}/V · s;

Sample 5170 A: $n_s = 2.4 \times 10^{11}$ cm^{-2}; $\mu = 24000$ cm^{-2}/V · s.

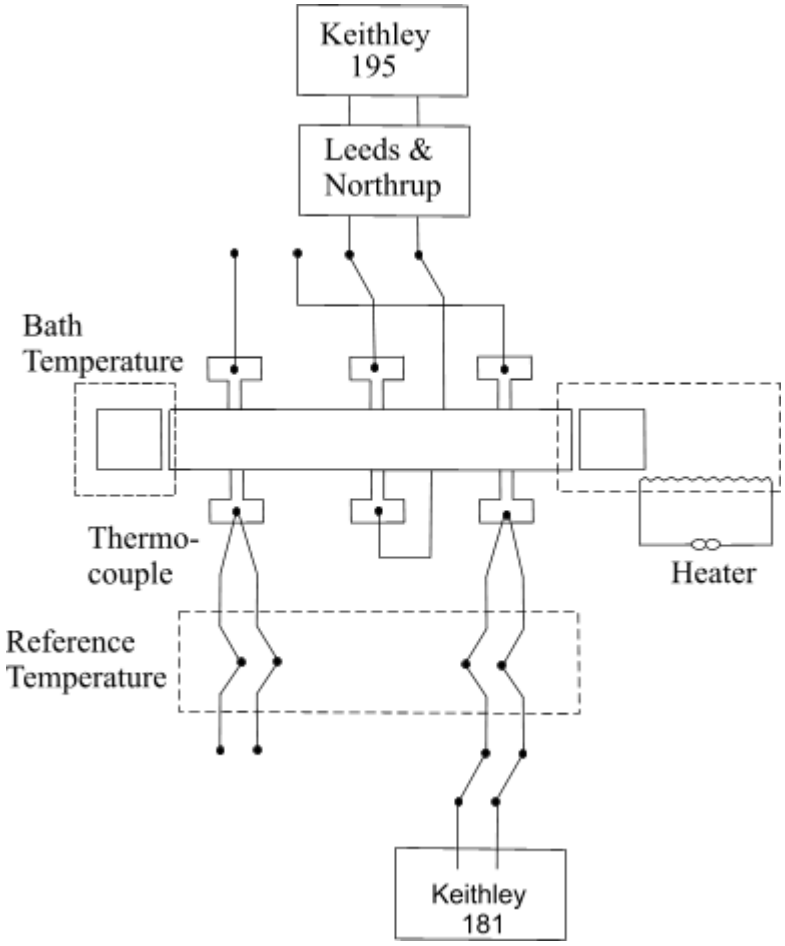

Fig. 1. Experimental set-up used for our thermopower measurements

References

[1] S.M. Girvin and M. Jonson. J. Phys. Cl5 (1982) L1147.

[2] S.P. Zelenin, AS. Kondrat’ev and A.E. Kuchma, Soviet Phys.-Semicond. 16 (1982) 355.