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Applying Van Der Pauw's Technique to Thermal Conductivity

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APPLYING VAN DER PAUW'S TECHNIQUE TO THERMAL CONDUCTIVITY

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When measuring electrical resistance, two leads (an input and an output) may be used so long as the resistance of the sample is large compared to that of the leads and the contacts, and as long as thermoelectric voltages are negligible in comparison to the signal of interest. However, multi-lead configurations can often provide further information. For example, a method due to van der Pauw can be used to extract the intrinsic electrical resistivity of a material even from samples having non-trivial geometry (where current flow is non-homogeneous).

Formally, there is a great similarity between electronic and heat transport. In 1999 researchers at the University of Freiburg, Germany took advantage of this similarity, and applied the van der Pauw technique to measurements of thermal conductivity. Because such a method provides a more detailed mapping of the thermal conductivity, we intend to explore the use of the van der Pauw technique to map out the intrinsic anisotropies in the thermal conductivity of a single crystal sample.

Moreover, by exploring the thermal conductivity of $SrTiO_3$ samples at very low temperatures (down to ~ 0.5 K), it may be possible to help explain some of the peculiar quantum effects seen in this material.