Quantum phase transitions (QPT) in disordered systems

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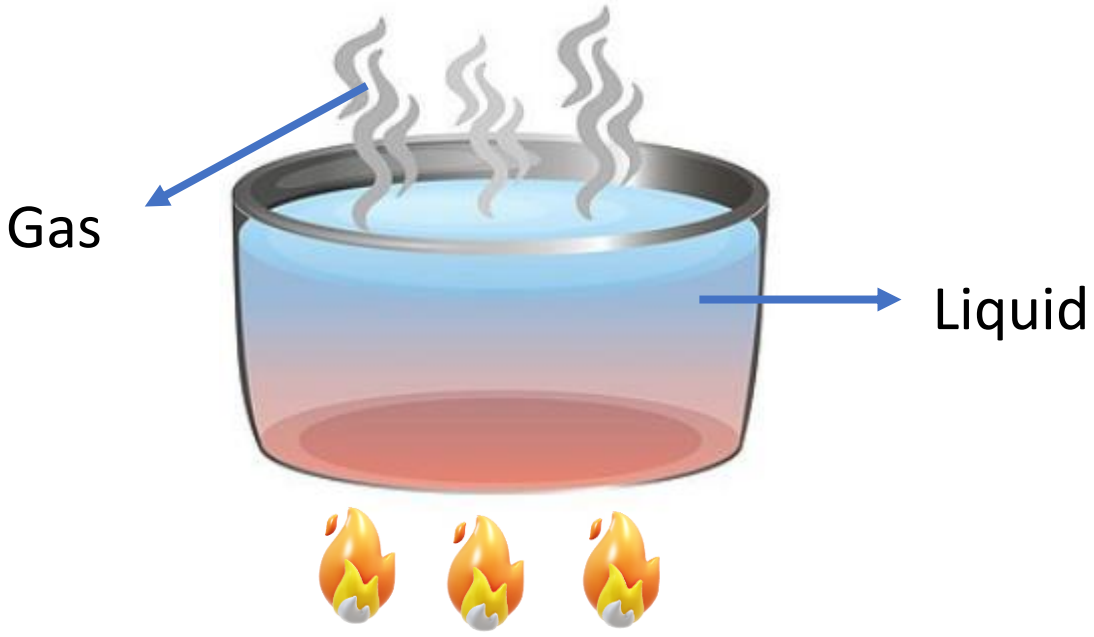
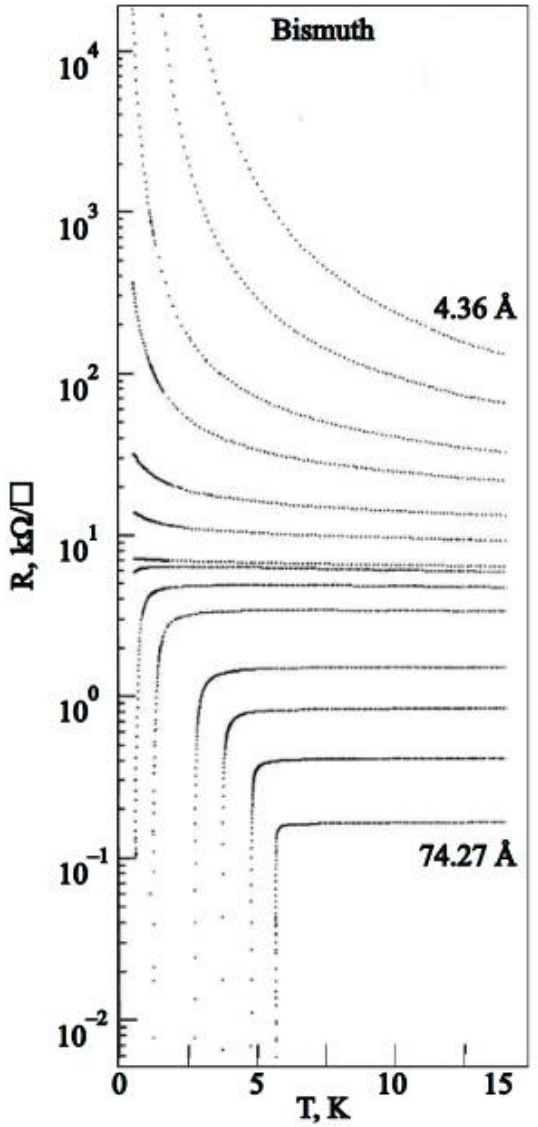
How do you define a QPT?

Thermal phase transition



QPT



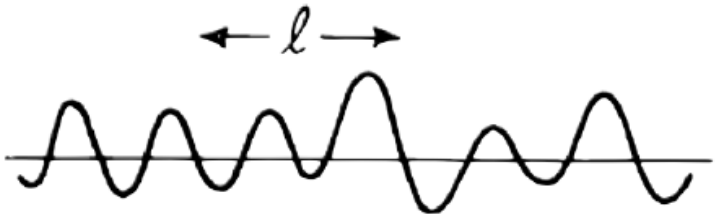
1. https://www.teachoo.com/12514/3426/Difference-between-Evaporation-and-Boiling/category/Extra-Questions/

2. Haviland et al., 1989

Effect of disorder on MIT

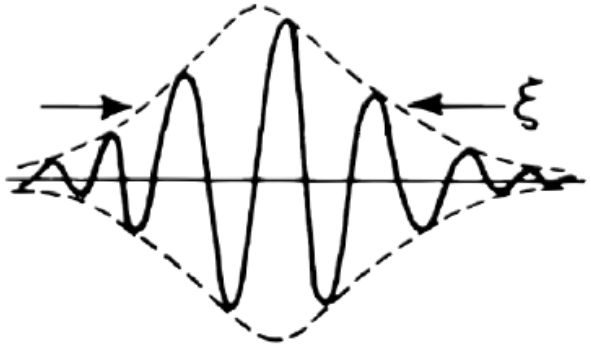
$$\psi_{\vec{k}}(\vec{r}) = e^{i\vec{k}\cdot\vec{r}} u_{\vec{k}}(\vec{r})$$

For weak disorder



The wave function is extended

In the presence of strong disorder



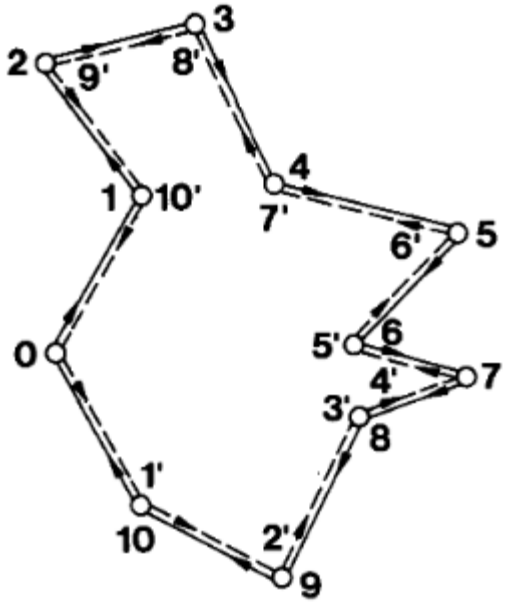
The wave function is localised

3. shutterstock.com

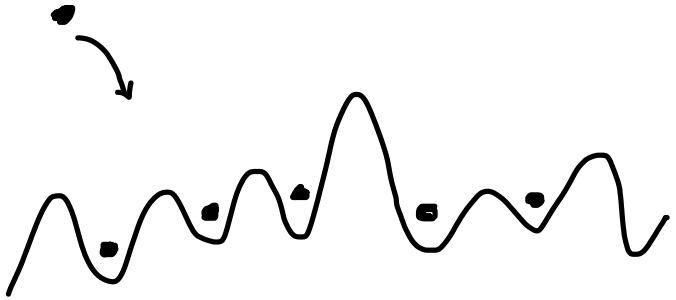
4. P.A. Lee and T.V. Ramakrishnan, 1985.

Phenomena in disordered systems

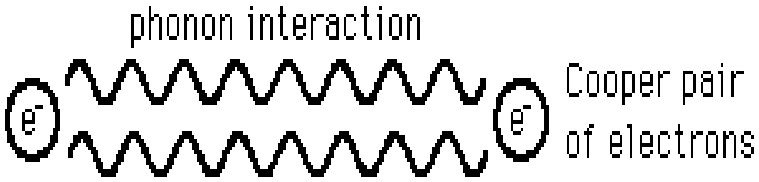
- Quantum interferences



- Coulomb interactions



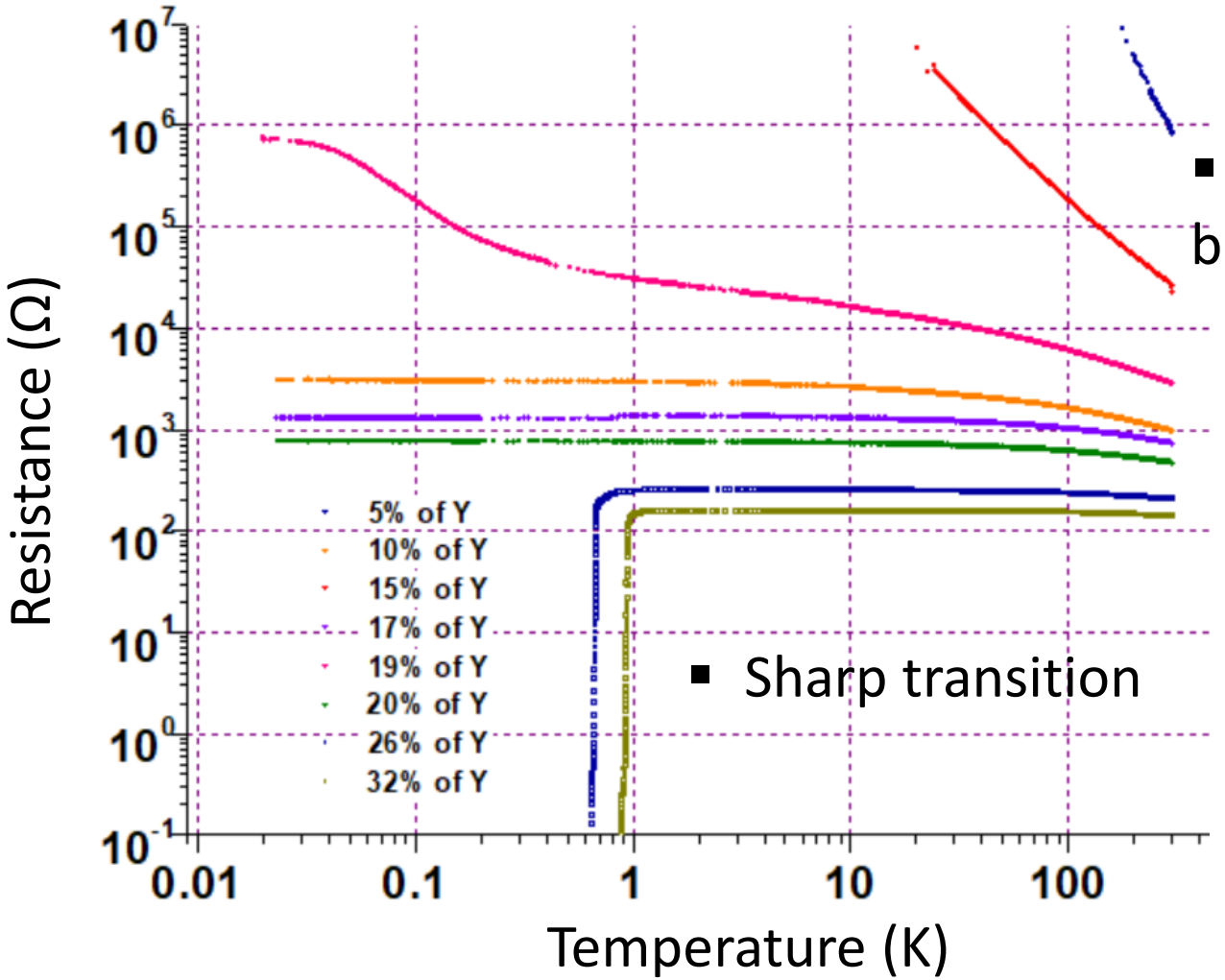
- Superconductivity



5. Bergmann, 1983.

6. http://ee.sharif.edu/~varahram/hts-course/bcs2.htm

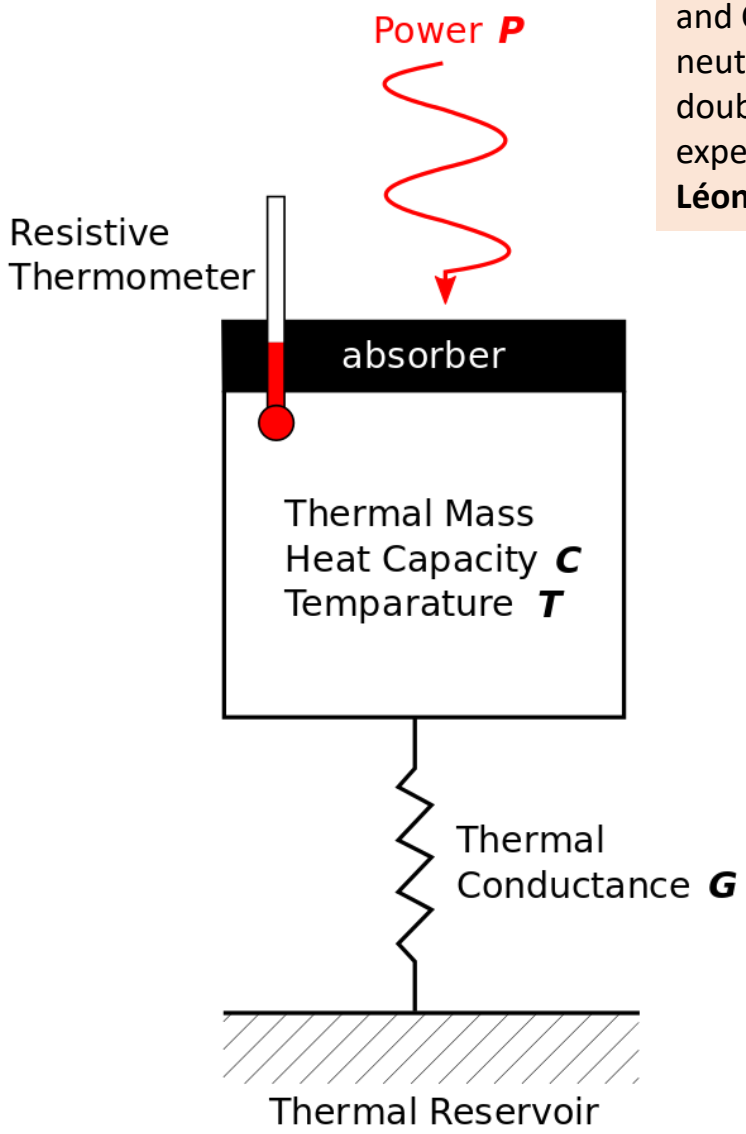
Y_xSi_{1-x}



- Resistive behaviour
- Sharp transition

In 3D
- Superconducting for x ≥ 21%
- Metallic for 21 % ≥ x ≥ 12 %
- Insulating for x ≤ 12 %

Bolometer

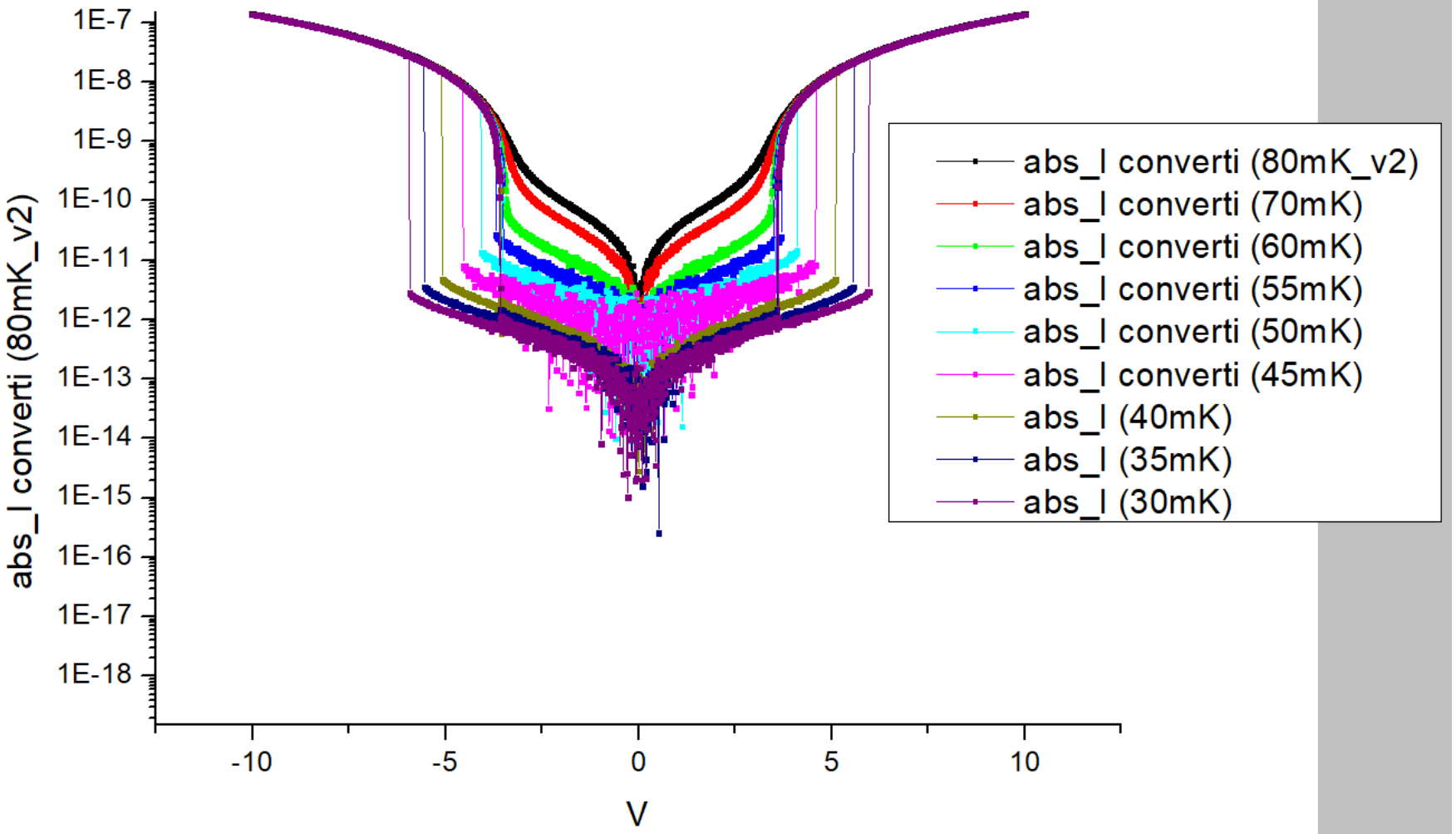


7.https://commons.wikimedia.org/wiki/File:Bolometer_conceptual_schematic.svg

Background studies for the CROSS, CUPID-Mo, and CUPID neutrinoless double beta decay experiments – **Léonard Imbert**

Conclusions

- Disordered systems are interesting both from a condensed matter point of view, and for very competitive thermal sensors.
- The 2nd issue is the thermal decoupling that exists in these systems, at very low temperature, between electrons and phonons.
- This phenomenon, specific to disordered systems, can have applications both for astroparticle detectors and for quantum computing.


abs_I converti (80mK_v2)
1E-7
1E-8
1E-9
1E-10
1E-11
1E-12
1E-13
1E-14
1E-15
1E-16
1E-17
1E-18
-10
-5
0
5
10
V
abs_I converti (80mK_v2)
abs_I converti (70mK)
abs_I converti (60mK)
abs_I converti (55mK)
abs_I converti (50mK)
abs_I converti (45mK)
abs_I (40mK)
abs_I (35mK)
abs_I (30mK)