

Contents

| | | |
|----------|---|----------|
| 1 | Basic concepts of the research field | 3 |
| 1.1 | Conductance at the atomic scale | 3 |
| 1.1.1 | Semiclassical description | 3 |
| | Bibliography | 5 |

Chapter 1

Basic concepts of the research field

Abstract

In this chapter, the basic concepts of electrical conductance in atomic and molecular junctions are discussed. Depending on the size of the contact, different regimes are expected. Electron tunneling and conductance quantization is explained together with characteristic measurements. Finally, we discuss how atomic or molecular levels and also vibrations can be observed in the measurements.

1.1 Conductance at the atomic scale

1.1.1 Semiclassical description

When considering a metallic wire of macroscopic dimensions, the electrical resistance of such a wire is simply given by Ohm's law. This relation states that the current through a wire (I), is proportional to the voltage over the wire (V), with $1/R$ as the proportionality constant (R is the resistance):

$$I = \frac{V}{R} \tag{1.1}$$

This relation was first found by Henry Cavendish in 1871, but named after Georg Ohm, who was the first to publish his experiments [1]...

References

- [1] T. Jain, F. Westerlund, E. Johnson, K. Moth-Poulsen, and T. Bjornholm, “Self-assembled nanogaps via seed-mediated growth of end-to-end linked gold nanorods,” *ACS Nano*, vol. 3, pp. 828–834, 2009.