



The Single Electron Transistor Renormalization Group analysis The complete quantum theory of a complex system.

Arthur La Rooij*

Supervisor: Prof. Dr. A. M. M. Pruisken[†]

Master Project Theoretical Physics

Master coordinator: Prof. Dr. B. Nienhuis[‡]

Faculty of Science, University of Amsterdam

Finished: 17 January 2011

Abstract.

The Single Electron Transistor (SET) is a metallic island coupled to two conducting reservoirs. In this masters research project a theory of physical observables is used to obtain the complete set of Renormalization Group equations for the SET. This theory defines new parameters that represent the quasi- charge and -conductance of the SET in the regimes of weak and strong coupling. The calculations that were made to derive the renormalization results are presented after an introduction into Single Electron Physics and the Coulomb blockade. The SET is found to have a robustly quantized quasi-charge. A complete phase diagram of the SET is presented. The fourth order correction to the action of the SET is found and analyzed. The effects of this correction to instanton solutions of the theory are studied. It is found that the correction to the instanton solutions are independent of the temperature.

* a.l.larooij@uva.nl

[†] A.M.M.Pruisken@uva.nl

[‡] B.Nienhuis@uva.nl