

# Fermionic Quantum Criticality

Jan Zaanen

*Instituut-Lorentz Universiteit Leiden, P.O. Box 9506, 2300 RA Leiden, The Netherlands*

**Abstract.** Humanity is in a state of ignorance when dealing with quantum systems composed of infinite numbers of fermionic particles. It is the infamous Fermion sign problem disabling the technologies of field theory: all one knows to do is to declare the system to be an adiabatic continuation of the Fermi-gas, or either to be bound in bosons. Empirically we know, however, that also scale invariant Fermion systems exist: these are well documented in the heavy fermion context and I will forcefully make the case that this fermionic quantum criticality is the secret of high  $T_c$  superconductivity. Resting on Ceperley's constrained Fermion path integrals we have reasons to hope that the sign problem can be cracked at least on the phenomenological level: our discovery of the fractal nodal surface hidden behind Fermionic backflow and why this is good for BCS superconductivity.