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Fermions and bosons : excitons in strongly correlated materials

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Title: Fermions and bosons : excitons in strongly correlated materials

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Propositions

to be defended along with the dissertation

Fermions and Bosons: Excitons in strongly correlated materials

I

The only experiments that unambiguously prove the existence of a Bose condensate should directly probe its long-range phase coherence. Examples include interference effects and quantization effects.

Chapter 2 of this thesis.

II

The appearance of higher-order peaks in the exciton spectrum of correlated bilayers indicates the presence of dynamical frustration.

Chapter 4 of this thesis.

III

In a strongly correlated bilayer exciton condensate the bandwidth of the magnetic excitations acts as a probe for the superfluid density.

Chapter 5 of this thesis.

IV

If excitons are bound in a strongly correlated bilayer, the system will most likely phase-separate in an antiferromagnetic phase, a superfluid phase and an exciton solid phase.

Chapter 5 of this thesis.

V

In the field of quantum matter, the main question is whether there exist macroscopic quantum (long-range entangled) states that cannot be reduced to classical (antisymmetrized product) states.

VI

There is nothing fluctuating about a superposition.

VII

First order quantum phase transitions have a largely unexplored potential to elucidate the notions of quantum superpositions and fluctuations.

VIII

Compressible macroscopic entangled matter cannot be used for quantum information purposes, because any finite disturbance pushes it into a thermal state before useful quantum computations can be done.

IX

The understanding of fermions can be improved by studying the breakdown or emergence of fermion statistics in two and more spatial dimensions.

X

The widespread susceptibility of the higher educated class towards antidemocratic opinions poses a greater threat to the stability of our society than left-wing, right-wing or religious extremism.

*See Mark Bovens and Anchrit Wille, 'Diplomademocratie';
the annual report of the Dutch Intelligence Service (AIVD) 2012;
Pieter van Os, 'Het vernietigende werk van de salonpopulist'.*

*Louk Rademaker,
11 December 2013*