

Measuring of Entanglement Entropy in Valence Bond Quantum Monte Carlo Simulations

by

Ann Berlinsky Kallin

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I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

In this thesis we present methods for measuring entanglement entropy in spin-1/2 Heisenberg systems using quantum Monte Carlo in the valence bond basis. We first directly compare the recently proposed valence bond entanglement entropy to the standard definition of entanglement entropy: the von Neumann entanglement entropy. We find both cases in which SHUT UP THESIS I HATE YOU

We explain VB QMC techniques:

- single projector
- double projector
- loop algorithm

Look at VB EE compared to vN

Look at Renyi EE

Area Laws

Acknowledgements

I would like to thank all the people who made this possible.

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Start off explaining what entanglement entropy is

Area Law

Corrections to Area Law

Definitions of entropy

1.1.1 The von Neumann Entanglement Entropy

1.1.2 The Area Law

1.2 something else to go in the introduction?

1.3 Entanglement Entropy

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Chapter 2

Quantum Monte Carlo in the Valence Bond Basis

2.1 Single Projector

2.2 Double Projector

2.3 Loop Moves

Chapter 3

Valence Bond Entanglement Entropy

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Chapter 4

Measuring Rényi Entanglement Entropy

4.1 The Swap Operator

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Chapter 5

Prospects for Future Research

Chapter 6

Conclusions

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