

Crystals and Quantum Computation: a Note

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Abstract

In this note, the authors juxtapose the works of Frohlich and Eastin and propose their integration.

Electrons in lattice structures like crystals are considered in the detailed quantum physics paper of H. Frohlich [1]. He studies the wave function of these electrons and the interaction with the lattice. This interaction can be seen either as a preparation or a measurement step, with intervening dynamics. Thus we ask if the entire theory of electrons in lattices can be combined with Bryan Eastin's quantum circuit model [2]. In other words, can we express Frohlich's detailed work in algorithm or circuit form? The result might be similar to the well-known model of cluster state quantum computation [3].

References

- [1] Herbert Fröhlich. Electrons in lattice fields. *Advances in Physics*, 3(11):325–361, 1954.
- [2] Bryan Eastin and Emanuel Knill. Restrictions on transversal encoded quantum gate sets. *Physical review letters*, 102(11):110502, 2009.
- [3] Michael A Nielsen. Cluster-state quantum computation. *Reports on Mathematical Physics*, 57(1):147–161, 2006.