

Project Title:

Quantum mechanics in superconducting electrical circuits

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I am using my RICC account for studies of dynamical quantum properties of superconducting electrical circuits, such as qubit circuits as candidates for possible building blocks in future quantum computing devices, and as artificial atoms and quantum field waveguides for fundamental studies on quantum-optics-like problems in the microwave regime.

In these studies I am using two software packages that I have developed myself (qdpack) and together with a colleague at RIKEN (qutip), respectively. Both are frameworks for numerical simulations of quantum dynamics of open systems, which use ODE solvers and sparse matrices for solving quantum master equations and the wave-function Monte-Carlo equations. More information about these open-source tools are available at:

<http://dml.riken.jp/~rob/qdpack.html>

and

<http://code.google.com/p/qutip/>

I have successfully used the above mentioned tools in a wide range of problems related to open quantum dynamics. Most recently in studies on the strongly driven quantum two-level systems and related transport properties.

For the next fiscal year I would like to continue using the RICC system and use our software framework qutip to conduct further studies of quantum properties of superconducting circuits and semiconductor devices.

RICC Usage Report for Fiscal Year 2011

Fiscal Year 2011 List of Publications Resulting from the Use of RICC

[Publication]

J.R. Johansson, P.D. Nation, F. Nori, QuTiP: An open-source Python framework for the dynamics of open quantum systems, arXiv:1110.0573.

<http://arxiv.org/pdf/1110.0573v2.pdf>

This paper does not contain the RICC acknowledgement because the paper describes a tool that we have developed and adopted to run on RICC, but includes no calculation results. We plan to apply the methods and tools provided by this software framework in studies on numerical quantum dynamics in the near future, and plan to use the RICC for that.

Another manuscript on numerical simulations of the transport properties of a strongly driven double-quantum dot system is under preparation.

[Proceedings, etc.]

[Oral presentation at an international symposium]

[Others]