Qichen Song

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Education

Massachusetts Institute of Technology (MIT) *2018.02-present*
Major: Mechanical Engineering
Degree: Doctor of Philosophy (expected)

Massachusetts Institute of Technology (MIT) *2015.09-2018.02*
Major: Mechanical Engineering
Degree: Master of Science

Huazhong University of Science and Technology (HUST) *2011.09-2015.06*
Major: Thermal Energy and Power Engineering
Degree: Bachelor of Engineering

Research Experience

***Ab initio* study of electron-phonon interaction in PbTe** *2016.07-2017.6*
Advisor: Prof. Gang Chen

- A mode-by-mode electron-phonon scattering analysis based on parameter-free first-principles calculation.
- Electron transport properties by solving BTE with excellent agreement with experiments at room temperature.
- Electron/phonon mean free path: a complete spectrum of thermoelectric properties of PbTe.

Research on deep impurity level in thermoelectrics *2016.01-2016.07*
Advisor: Prof. Gang Chen

- Find through modeling that, depending on the material type and temperature range of operation, different impurity levels (shallow or deep) will be desired to optimize the efficiency of a thermoelectric material

Research on coupling between different phonon modes in graphene *2014.09-2015.6*
Advisor: Prof. Nuo Yang, Dr. Meng An

- Built an model to manipulate in-plane/out-of-plane temperature gradient
- Investigated coupling between different phonon modes (TA, LA and ZA) and their contributions to thermal conductivity

Research on modulation of thermal conductivity in folded graphene *2013.11-2015.6*
Advisor: Prof. Nuo Yang

- Independently wrote FORTRAN code of nonequilibrium molecular dynamics
- Designed innovative structure to reduce the thermal conductivity significantly
- Obtained size-independent thermal conductivity that characterizes large-area folded graphene's thermal properties

Publications

Q. Zhang, **Q.C. Song**, X.Y. Wang, J.Y. Sun, Q. Zhu, K. Dahal, X. Lin, F. Cao, J.W. Zhou, S. Chen, G. Chen, Z.F. Ren, 'Functionally graded doping for High Thermoelectric Efficiency', **2017**, *in preparation.*

J.W. Zhou, H.T. Zhu, T.H. Liu, **Q.C. Song**, R. He, J. Mao , Z.H. Liu, W.Y Ren, B. Liao, D. J. Singh, Z.F. Ren, G. Chen, ' The origin of large thermoelectric power factors in half- Heusler systems', **2017**, *submitted to Nat. Commun.*

M.D. Li, **Q.C Song**, W.W. Zhao, J. A. Garlow, T.H. Liu, L.J. Wu, Y.M. Zhu, J. S. Moodera, M. H. W. Chan, G. Chen, and C-Z Chang, 'Dirac-electron-mediated magnetic proximity effect in topological insulator/magnetic insulator heterostructures' , **2017**, 96, 201301, *Phys. Rev. B: Rapid Communications.*

T.H. Liu , J.W. Zhou , M.D. Li , Z.W. Ding , **Q.C. Song** , B. Liao , L. Fu, G. Chen, ' Electron Mean-Free-Path Filtering in Dirac Material for Improved Thermoelectric Performance', *Proc. Natl. Acad. Sci.*, **2017**, accepted.

Q.C. Song, T.H. Liu, J.W. Zhou, Z.W. Ding, G. Chen, '*Ab initio* study of electron mean free paths and thermoelectric properties of lead telluride', *Material Today Physics*, **2017**, 2, 69-77.

M. An, **Q.C. Song**, X.X. Yu, Z.L. Jin, D.K. Ma, B.L. Huang, N. Yang, 'Generalized two-temperature model for coupled phonons', *Nano Lett.*, **2017**, 17 (9), 5805-5810.

M.D. Li, **Q.C. Song**, T.H. Liu, L. Meroueh, G.D. Mahan, M.S. Dresselhaus, G. Chen, 'Tailoring superconductivity with quantum dislocations', *Nano Lett.*, **2017**, 17 (8), 4604-4610.

Q.C. Song, J.W. Zhou, L. Meroueh, D. Broido, Z.F. Ren, G. Chen, 'The effect of shallow vs. deep level doping on the performance of thermoelectric materials', *Appl. Phys. Lett.*, **2016**, 109, 263902.

Q.C. Song, M. An, X.D. Chen, Z. Peng, J.F. Zang, N. Yang, 'The adjustable thermal resistor by reversibly folding a graphene sheet', *Nanoscale*, **2016**, 8, 14943-14949.

Conference Presentation

Q.C. Song, T.H. Liu, J.W. Zhou, G. Chen, Ab-initio study of electron transport in lead telluride at APS March Meeting 2017, Session B34.00012 at New Orleans, LA, Mar. 13, 2017.

Honors and Awards

Warren M. Rohsenow Fellowship *2015-2016*
Awarded by Department of Mechanical Engineering, MIT

National Scholarship (Three times) *2012,2013,2014*
Top 1% among all competitors, awarded by Ministry of Education of PRC

Outstanding Student of Huazhong Univ. of Sci. & Tech. *2012-2014*
Top 1% among all 2nd & 3rd year students, one of the top honor for undergraduates

Excellent Award in the 3rd National Water Resource Innovation Design Competition *2013.07*

Computer Skills

FORTRAN90(MPI), C++, Python, MATLAB/Simulink, LaTeX