

BENJAMIN K CHANG

Physics / Materials Science / Computer Science / Machine Learning

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EDUCATION

National Taiwan University (NTU), M.S. in Physics 09/2015-07/2017

Thesis: First-Principles Studies of Cubic Sb-Doped GeTe Compounds for Thermoelectric Applications ([link](#))

Graduated with **Dean's Award** (Please refer to **HONORS AND AWARDS**)

National Tsing Hua University (NTHU), B.S. in Interdisciplinary Program of Sciences (IPCS) 09/2011-06/2015

Fields of study: **Physics** and **Materials Science**, Minor in **Computer Science**

Graduate Ranking: 1/27 (**top 3.7%**) || GPA: **3.94/4.0 (4.03/4.3)**

Coursera Online Course Certificates in Machine Learning & Deep learning 2017

PUBLICATIONS

1. Deniz P. Wong, Masoud Aminzare, Chin-Sheng Pang, **Benjamin K. Chang**, Hsiang-Ting Lien, Sun-Tang Chang, Chia-Hua Chien, Yang-Yuan Chen, Ming-Wen Chu, Yaw-Wen Yang, Wen-Pin Hsieh, Gerda Rogl, Peter Rogl, Mei-Yin Chou, Li-Chyong Chen, and Kuei-Hsien Chen. “*Boosting zT above 2.5: Temperature-Induced Valence Band Convergence in GeTe-rich Ge-Sb-Te Thin Film.*” In preparation for submission.
2. **Benjamin K. Chang** and Mei-Yin Chou. “*First-Principles Studies of Cubic Sb-Doped GeTe for Thermoelectric Applications.*” In preparation for submission to *Physical Review B*.

RESEARCH EXPERIENCES

Institute of Atomic and Molecular Sciences (IAMS), Academia Sinica, Taipei 09/2015-present

PI: [Prof. Mei-Yin Chou](#) (Vice President of Academia Sinica)

Investigation on the Thermal Property of Cmc₂m-SnSe Using Machine Learning, Post-Master Study

- Collaborating with a Physics Ph.D. student at Georgia Institute of Technology.
- Applied a machine learning method called “Compressive Sensing” with nearly 10,000 atomic displacement data derived from DFT, and identified the large anharmonic force constants of Cmc₂m-SnSe.

First-Principles Studies of Cubic Sb-Doped GeTe for Thermoelectric Applications, Master's Study

- Collaborated with the experimental group of [Prof. Kuei-Hsien Chen](#) (Director of IAMS).
- Found that the presence of Sb leads to the stabilization of cubic phase Sb-doped GeTe (β -GST).
- Verified the applicability of the cubic GeTe rigid band model to β -GST system.
- Implemented an original quantitative analysis in Python for the comparison of unfolded supercell band structures.
- Found that the superior electronic properties of β -GST originate from the expansion of the electronic phase space.
- Predicted that the choice of substrate used in the experiments affects the resulting thermoelectric performance of β -GST. Later confirmed by experiments.

Department of Physics, Fudan University, Shanghai 07/2013-08/2013

PI: [Prof. Jian Shen](#) (Director of the Department)

Giant Magnetoresistance of Organic Spin Valves, Undergrad Exchange Research Project

- Assisted the growth of Co/Alq₃/LSMO film using molecule beam epitaxy (MBE).
- Implemented a user-friendly monitor program by using LabVIEW.
- This work was finalized and published by the group in *Nature Communications* **5**:4396 (2014).

SKILLS

First-Principles Computation	VASP, Quantum Espresso, BandUP, BoltzTraP, Phonopy
Machine & Deep Learning	Tensorflow, Scikit-learn
Programming Languages	Python, C/C++, Matlab, Shell Script, HTML5/CSS, Javascript, PHP, SQL, LabVIEW

HONORS AND AWARDS

Dean's Award, College of Science, NTU	08/2017
Awarded to graduate students outstanding in graduate academic research annually.	
Phi Tau Phi Honorary Membership, Phi Tau Phi Scholastic Honor Society of the Republic of China	06/2016
Awarded to top 1% undergraduate students annually.	
College of Science Elite Student Award, College of Science, NTHU	04/2015
Awarded to 1 student in each year in each department in the College of Science annually.	
Academic Achievement Award (2 times), NTHU	02/2013-01/2014
Awarded to top 5% students of each department, every semester.	
Yu Kuo-Hua Scholarship, Yu Kuo-Hua Foundation	12/2013
Awarded to 2 students in the College of Science at NTHU annually.	
Chun-Tsung Scholar, Hui-Chun Chin and Tsung-Dao Lee Chinese Undergraduate Research Endowment	11/2013
Awarded annually to 2 undergrad students outstanding in research from each of the following universities: National Tsing Hua, Peking, Fudan, Shanghai Jiao Tong, Soochow, and Lanzhou University. Each recipient is invited to give a talk on the Chun-Tsung Annual Conference.	
Dr. Chen Ke-Zhong Memorial Scholarship, NTHU	10/2013
Awarded to 1 student in the College of Science every semester.	
Mr. Ma Shang-Keng Memorial Scholarship, NTHU	10/2013
Awarded to 2 students outstanding in "subjects in physics" annually.	
Mr. Jiang Ying-Bin Memorial Scholarship, NTHU	10/2013
Awarded to 1 NTHU student outstanding in both academic performance and team activities annually.	
Academic Exchange Scholarship to People's Republic of China, NTHU	07/2013-08/2013
Awarded to a small number of students with good academic performance annually.	
Student Award, Department of IPCS, NTHU	11/2012
Awarded to outstanding students in the Department of IPCS annually.	

POSTERS

First-Principles Studies of Cubic Sb-Doped GeTe for Thermoelectric Applications,	10/2017
<i>The 20th Asian Workshop on First-Principles Electronic Structure Calculations (link), Nanjing, China</i>	
First-Principles Studies of Cubic Sb-Doped GeTe for Thermoelectric Applications,	09/2017
<i>IAMS-Yokohoma City Univeristy Autumn Workshop (link), IAMS, Taipei, Taiwan</i>	

TALKS

Introduction to Machine Learning, IAMS Theory Groups Joint Meeting, Taipei, Taiwan	07/2017
Gave a pedagogical talk in English on the current development of machine learning, including pattern recognition problems, regularization, deep neural networks, and gradient descent method. About 20 attendants.	
Electron Localization Function, IAMS Theory Groups Joint Meeting, Taipei, Taiwan	08/2016
Gave a pedagogical talk in English on the development and the application of electron localization function. About 20 attendants.	
Low Thermal Conductivity Thermoelectric Materials, IAMS Theory Groups Joint Meeting, Taipei, Taiwan	05/2016

Gave a pedagogical talk in English on modern approaches of reducing thermal conductivity of thermoelectric materials, including anharmonicity, cage-like structures, phonon gap production, and lone-pair electrons. About 20 attendants.

Experimental Study on Giant Magnetoresistance, *Chun-Tsung Annual Conference, Beijing, China* 11/2013

Gave a talk on the exchange research experience, including the introduction of giant magnetoresistance, the operation of MBE, and LabVIEW.

TEACHING EXPERIENCES

TA, Classical Mechanics (Graduate Course), Prof. Kazuo Hosomichi, *Department of Physics, NTU* 09/2016-01/2017

Marking homework, answering online questions, and offering office hours. All in English. 34 students.

TA, Quantum Physics (Undergrad Course), Prof. Yeong-Chuan Kao, *Department of Physics, NTU* 09/2016-01/2017

Making lecture notes, answering after-class questions. About 100 students.

Teacher of NTHU Belize Educational Volunteer Service Group, *Cayo District, Belize* 07/2014-08/2014

Taught basic computer concepts in English with the help of simple Spanish dialogs. More than 150 Belizean children between 6-15 years old.

Dean's Honorable Peer Tutor, *NTHU* 09/2013-06/2014

Offered after-class guidance of selected subjects in mathematics, physics, materials science, and computer science for any NTHU students who made an appointment online, in both Chinese and English.

COURSES AND OVERALL GPA

Physics	Computer Science
Undergraduate (GPA: 4.0 /4.0 4.19 /4.3)	Undergraduate (GPA: 4.0 /4.0 4.16 /4.3)
-Quantum Mechanics (I) (A+)	-Design and Analysis of Algorithms (A+)
-Thermal and Statistical Physics (I) (A+)	-Operating Systems (A)
-Quantum Physics (I, II) (A+, A)	-Computer Architecture (A)
-Electromagnetics (I, II) (A+, A+)	-Data Structures (A+)
-Theoretical Mechanics (I, II) (A+, A+)	-Logic Design (A)
-Introduction to Elementary Particle Physics (II) (A+)	-Scientific Computing (A+)
-Applied Mathematics (I, II) (A, A-)	-Web Programming, Technologies, and Applications (A+)
Graduate (Average GPA: 4.0 /4.0 4.14 /4.3)	-Introduction to Programming (A+)
-Quantum Mechanics (I, II) (A, A+)	-Linear Algebra (I, II) (A+, A)
-Statistical Physics(I) (A+)	-Statistics (A)
-Classical Electrodynamics (I) (A)	
-Classical Mechanics (A)	
-Topics on Theoretical Materials Physics (A+)	
Materials Science	Machine Learning
Undergraduate (GPA: 3.96 /4.0 4.00 /4.3)	Coursera Online Courses (Passed with Certificates)
-Biomedical Materials (A-)	-Machine Learning
-The Physical Properties of Materials (A+)	-Neural Networks and Deep Learning
-Ceramic Materials (A-)	-Structuring Machine Learning Projects
-Introduction to Crystal Structure and Diffraction Theories (A+)	-Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization
-Material Science and Engineering (I, II) (A+, A+)	(All offered by Prof. Andrew Ng at Stanford University)
-Thermodynamics of Materials (I, II) (B+, A)	

WORKING EXPERIENCES

Research Assistant, IAMS, Academia Sinica	Part-Time: 02/2016-07/2017 Full-Time: 08/2017-present
Teaching Assistant, Classical Mechanics, Department of Physics, NTU	09/2016-01/2017
Teaching Assistant, Quantum Physics, Department of Physics, NTU	09/2016-01/2017

TERM PROJECT

Thermal Transport Theory	2016
Reviewed the formulations of thermal transport, including Born-Oppenheimer approximation, anharmonic interactions, Boltzmann equation, and the formula for thermal conductivity.	

LEADERSHIP AND TEAMWORK EXPERIENCES

Programmer and Strategy Designer, FDT Global College Student Investment Competition	03/2016-06/2016
Collaborated with 4 other teammates from different fields. Used Python to implement foreign exchange transaction strategies on the platform provided by Financial Data Technologies (FDT) Ltd.	
Chief of the Web and Information Division, NTHU Graduate Student Association	09/2014-06/2015
Led division members in designing and creating the association website.	
Representative Speaker, Exchange Workshop of Economics, Tsinghua University, Beijing	07/2014
Represented NTHU group to give a talk about education industry's impact on Taiwanese economy at the exchange workshop held by the departments of Economics of Tsinghua University (Beijing) and NTHU.	
Fundraiser and Member of the Media Division, NTHU Belize Educational Volunteer Service Group	11/2013-10/2014
Produced promotion videos, gave fundraising presentations, gained sponsorship at various charity bazaars, eventually, with colleagues, gathered over 33,000 USD and 40 computer sets in a few months.	
-Updated 2017.11.11	