BENJAMIN K CHANG

Physics | Materials Science | Computer Science | Machine Learning

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EDUCATION

National Taiwan University (NTU), M.S. in **Physics** 09/2015-06/2017

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

Graduated with **Dean's Award** || GPA: **4.0**/4.0 (**4.12**/4.3)

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 submission to *Advanced Materials*.
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)

Quantum Confinement Effect on Cu Nanowires, *Post-Master Study (ongoing industrial project)*

- Collaborating with Prof. King-Ning Tu (Professor Emeritus, Dept. Materials Science & Engineering at UCLA).

Investigation on the Thermal Property of Cmcm-SnSe Using Machine Learning, *Post-Master Study (ongoing)*

- 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 Cmcm-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 and complex geometry of the electron 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 (Chair of the Department)

Giant Magnetoresistance of Organic Spin Valves, *Undergrad Exchange Research Project*

- Assisted the growth of Co/Alq_3/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

Gold Prize, IAMS Young Fellow Research Presentation Contest, *IAMS, Academia Sinica* 11/2017
Awarded to the best research presenter among the 27 contestants of postdocs, RAs and students from IAMS.

Dean's Award, *College of Science, NTU* 08/2017
Awarded to graduate students outstanding in graduate academic research.

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.

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

B. K. Chang & M.-Y. Chou, "First-Principles Studies of Cubic Sb-Doped GeTe for Thermoelectric Applications",
The 20th Asian Workshop on First-Principles Electronic Structure Calculations (link), *Nanjing, China* 10/2017

B. K. Chang & M.-Y. Chou, "First-Principles Studies of Cubic Sb-Doped GeTe for Thermoelectric Applications",
IAMS-Yokohoma City Univeristy Autumn Workshop (link), *IAMS, Taipei, Taiwan* 09/2017

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.

Report on the Experimental Study of Organic Films, *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.

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.

COURSES AND OVERALL GPA

* The GPA in 4.0 scale is calculated by using the World Education Service (WES).

Physics

Undergraduate (GPA: **4.0**/4.0 || **4.19**/4.3)

-Quantum Mechanics (I) (A+)
-Thermal and Statistical Physics (I) (A+)
-Quantum Physics (I, II) (A+, A)
-Electromagnetics (I, II) (A+, A+)
-Theoretical Mechanics (I, II) (A+, A+)
-Introduction to Elementary Particle Physics (II) (A+)
-Applied Mathematics (I, II) (A, A-)

Graduate (Average GPA: **4.0**/4.0 || **4.14**/4.3)

-Quantum Mechanics (I, II) (A, A+)
-Statistical Physics(I) (A+)
-Classical Electrodynamics (I) (A)
-Classical Mechanics (A)
-Topics on Theoretical Materials Physics (A+)

Computer Science

Undergraduate (GPA: **4.0**/4.0 || **4.16**/4.3)

-Design and Analysis of Algorithms (A+)
-Operating Systems (A)
-Computer Architecture (A)
-Data Structures (A+)
-Logic Design (A)
-Scientific Computing (A+)
-Web Programming, Technologies, and Applications (A+)
-Introduction to Programming (A+)
-Linear Algebra (I, II) (A+, A)
-Statistics (A)

Materials Science

Undergraduate (GPA: **3.89**/4.0 || **4.00**/4.3)

-Biomedical Materials (A-)
-The Physical Properties of Materials (A+)
-Ceramic Materials (A-)
-Introduction to Crystal Structure and Diffraction Theories (A+)
-Material Science and Engineering (I, II) (A+, A+)
-Thermodynamics of Materials (I, II) (B+, A)

Machine Learning

Coursera Online Courses (Passed with **Certificates**)

-Machine Learning
-Neural Networks and Deep Learning
-Structuring Machine Learning Projects
-Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization
(All offered by Prof. Andrew Ng at Stanford University)

– Last updated 2017.12.14