

# BENJAMIN K CHANG

*Physics / Materials Science / Computer Science / Machine Learning*

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## EDUCATION

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**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

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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.
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

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**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 Cmc<sub>2</sub>m-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 Cmc<sub>2</sub>m-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 ( $\beta$ -GST).
- Verified the applicability of the cubic GeTe rigid band model to  $\beta$ -GST system.
- Implemented an original quantitative analysis in Python for the comparison of unfolded supercell band structures.
- Found that the superior electronic properties of  $\beta$ -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  $\beta$ -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/Alq<sub>3</sub>/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

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

## HONORS AND AWARDS

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<b>Gold Prize of the IAMS Young Fellow Research Presentation Contest, IAMS, Academia Sinica</b>	11/2017
Awarded to the best research presenter among the 27 contestants of postdocs, RAs and students from IAMS.	
<b>Dean's Award, College of Science, NTU</b>	08/2017
Awarded to graduate students outstanding in graduate academic research annually.	
<b>Phi Tau Phi Honorary Membership, Phi Tau Phi Scholastic Honor Society of the Republic of China</b>	06/2016
Awarded to top 1% undergraduate students annually.	
<b>College of Science Elite Student Award, College of Science, NTHU</b>	04/2015
Awarded to 1 student in each year in each department in the College of Science annually.	
<b>Academic Achievement Award (2 times), NTHU</b>	02/2013-01/2014
Awarded to top 5% students of each department, every semester.	
<b>Yu Kuo-Hua Scholarship, Yu Kuo-Hua Foundation</b>	12/2013
Awarded to 2 students in the College of Science at NTHU annually.	
<b>Chun-Tsung Scholar, Hui-Chun Chin and Tsung-Dao Lee Chinese Undergraduate Research Endowment</b>	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.	
<b>Dr. Chen Ke-Zhong Memorial Scholarship, NTHU</b>	10/2013
Awarded to 1 student in the College of Science every semester.	
<b>Mr. Ma Shang-Keng Memorial Scholarship, NTHU</b>	10/2013
Awarded to 2 students outstanding in "subjects in physics" annually.	
<b>Mr. Jiang Ying-Bin Memorial Scholarship, NTHU</b>	10/2013
Awarded to 1 NTHU student outstanding in both academic performance and team activities annually.	
<b>Academic Exchange Scholarship to People's Republic of China, NTHU</b>	07/2013-08/2013
Awarded to a small number of students with good academic performance annually.	
<b>Student Award, Department of IPCS, NTHU</b>	11/2012
Awarded to outstanding students in the Department of IPCS annually.	

## POSTERS

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

## TALKS

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<b>Introduction to Machine Learning, IAMS Theory Groups Joint Meeting, Taipei, Taiwan</b>	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.	
<b>Electron Localization Function, IAMS Theory Groups Joint Meeting, Taipei, Taiwan</b>	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.

## COURSES AND OVERALL GPA

<b>Physics</b> Undergraduate (GPA: <b>4.0</b> /4.0    <b>4.19</b> /4.3)	<b>Computer Science</b> Undergraduate (GPA: <b>4.0</b> /4.0    <b>4.16</b> /4.3)
<ul style="list-style-type: none"> <li>-Quantum Mechanics (I) (A+)</li> <li>-Thermal and Statistical Physics (I) (A+)</li> <li>-Quantum Physics (I, II) (A+, A)</li> <li>-Electromagnetics (I, II) (A+, A+)</li> <li>-Theoretical Mechanics (I, II) (A+, A+)</li> <li>-Introduction to Elementary Particle Physics (II) (A+)</li> <li>-Applied Mathematics (I, II) (A, A-)</li> </ul> Graduate (Average GPA: <b>4.0</b> /4.0    <b>4.14</b> /4.3)	<ul style="list-style-type: none"> <li>-Design and Analysis of Algorithms (A+)</li> <li>-Operating Systems (A)</li> <li>-Computer Architecture (A)</li> <li>-Data Structures (A+)</li> <li>-Logic Design (A)</li> <li>-Scientific Computing (A+)</li> <li>-Web Programming, Technologies, and Applications (A+)</li> <li>-Introduction to Programming (A+)</li> </ul>
<ul style="list-style-type: none"> <li>-Quantum Mechanics (I, II) (A, A+)</li> <li>-Statistical Physics(I) (A+)</li> <li>-Classical Electrodynamics (I) (A)</li> <li>-Classical Mechanics (A)</li> <li>-Topics on Theoretical Materials Physics (A+)</li> </ul>	<ul style="list-style-type: none"> <li>-Linear Algebra (I, II) (A+, A)</li> <li>-Statistics (A)</li> </ul>
<b>Materials Science</b> Undergraduate (GPA: <b>3.96</b> /4.0    <b>4.00</b> /4.3)	<b>Machine Learning</b> Coursera Online Courses (Passed with <b>Certificates</b> )
<ul style="list-style-type: none"> <li>-Biomedical Materials (A-)</li> <li>-The Physical Properties of Materials (A+)</li> <li>-Ceramic Materials (A-)</li> <li>-Introduction to Crystal Structure and Diffraction Theories (A+)</li> <li>-Material Science and Engineering (I, II) (A+, A+)</li> <li>-Thermodynamics of Materials (I, II) (B+, A)</li> </ul>	<ul style="list-style-type: none"> <li>-Machine Learning</li> <li>-Neural Networks and Deep Learning</li> <li>-Structuring Machine Learning Projects</li> <li>-Improving Deep Neural Networks: Hyperparameter tuning, Regularization and Optimization</li> </ul> (All offered by Prof. Andrew Ng at Stanford University)

## WORKING EXPERIENCES

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

## TERM PROJECT

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<b>Thermal Transport Theory</b>	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

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<b>Programmer and Strategy Designer, FDT Global College Student Investment Competition</b>	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.	
<b>Chief of the Web and Information Division, NTHU Graduate Student Association</b>	09/2014-06/2015
Led division members in designing and creating the association website.	
<b>Representative Speaker, Exchange Workshop of Economics, Tsinghua University, Beijing</b>	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.	
<b>Fundraiser and Member of the Media Division, NTHU Belize Educational Volunteer Service Group</b>	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.	

– Last updated 2017.11.16