

Ting-Yun CHENG (Sunny)

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 ting-yun.cheng@durham.ac.uk |  @AstroSunnyC |  tycheng-sunny

Education

School of Physics and Astronomy, University of Nottingham, Nottingham, UK

PhD in Physics, 2017 – 2020

- **Supervisor:** Prof. Christopher J. Conselice and Prof. Alfonso Aragón-Salamanca
- **Thesis:** The Narrative of Galaxy Morphological Classification Told Through Machine Learning

Institute of Astronomy, National Tsing Hua University, Hsinchu, Taiwan

MSc in ASTRONOMY, 2014 – 2016

- **Supervisor:** Prof. Ing-Guey Jiang
- **Thesis:** Investigating Dark Matter Distribution in Early-Type Galaxies

Department of Physics, National Taiwan Normal University, Taipei, Taiwan

BSc in PHYSICS, 2010 – 2014

Research Experience

* Collaborators' affiliations listed here are the ones when the collaboration was carried out.

Centre for Extragalactic Astronomy, Durham University, Durham, UK

PDRA, Nov. 2020 – Now

• **Leading Projects:**

- I. Collaborating with Dr Ryan Cooke (Durham University, UK) in several studies of the Lyman alpha (Ly α) forest, intergalactic medium (IGM) and circumgalactic medium (CGM).
 - i. Identification and characterisation of the Ly α forest using convolutional neural networks (CNNs). **The paper is published on MNRAS in 2022.**
 - ii. Fast detection of Deuterium (DI) systems with low column density using CNNs. We will use these DI systems to constrain the temperature and density relation of IGM/CGM. The paper is in Prep.
 - iii. The connection between Ly α absorbers and the global properties of host galaxies. The work is in progress.
- II. Collaborating with Helena Domínguez Sánchez (Institute of Space Sciences, Spain) and the Dark Energy Survey (DES) organisation on a massive comparison of two largest galaxy morphological classification catalogues, including over 20 million galaxies each. This comparison provides a further cross-validation for catalogue users and a better understanding in deep learning applications for future users of convolution neural networks. **The paper is submitted to MNRAS.**

• **Collaborating Projects:**

- I. Collaborating in a project led by Dr Dani Chao (Institute Ruđer Bošković, Croatia) to predict ionisation parameter from galaxy colour images using deep learning. The work is in progress.
- II. Collaborating in a project led by Dr Lupin Lin (National Chen Kung University, Taiwan) to use CNNs for gravitation wave detection and parametrisation. The work is in progress.

School of Physics and Astronomy, University of Nottingham, Nottingham, UK

PhD in Physics, 2017 – 2020

- **Leading Projects:**

- I. Collaborated with Prof. Chris Conselice and Prof. Alfonso Aragón-Salamanca (University of Nottingham, UK) and the DES organisation on a series of projects to create a galaxy morphological classification catalogue for DES using machine learning techniques.
 - i. Examining several supervised machine learning methods such as k-nearest neighbour, support vector machine, random forest, neural networks, and convolutional neural networks on the galaxy morphological classification using DES imaging data. **The paper is published on MNRAS in 2020.**
 - ii. Using the chosen method to build one of the largest galaxy morphological classification catalogues, which includes 20 million galaxies, using CNNs for DES Y3 data. **The paper is published on MNRAS in 2021, and the catalogue is published with the DES Y3 release in 2021.**
- II. Collaborated with Dr Nan Li (University of Nottingham, UK) on the project of classifying galaxy-galaxy strong lensing system using an unsupervised convolutional autoencoder. **The paper is published on MNRAS in 2020.**
- III. Collaborated with Prof. Marc Huertas-Company (the Instituto de Astrofísica de Canarias, Spain) on the study of galaxy morphology using an unsupervised machine learning technique. **The paper is published on MNRAS in 2021.**

- **Collaborating Projects:**

- I. Collaborated in a project led by Leonardo Ferreira (University of Nottingham, UK) on creating a major-merger classifier using CNNs. **The paper is published on ApJ in 2020.**

University of California Santa Cruz, Santa Cruz, USA

KAVLI STUDENT FELLOW, Jul. – Aug. 2019

- Explored the application of a machine learning technique called 'Vector Quantised Variational Autoencoder' from Google DeepMind on an unsupervised machine learning application for morphology classification of galaxies as well as galaxy images emulation. Preliminary pipelines for both tasks are available on GitHub¹².

1. <https://github.com/tycheng-sunny/Unsupervised-ML-on-Galaxy-Morphology-using-VQ-VAE>

2. <https://github.com/tycheng-sunny/VQ-VAE-for-emulating-galaxy-images>

Institute of Astronomy, National Tsing Hua University, Hsinchu, Taiwan

MSc in ASTRONOMY, 2014 – 2016

- MSc Thesis - "**Investigating Dark Matter Distribution in Early-Type Galaxies**"
- Analysed the surface brightness profile of early-type galaxies using IRAF on images from the Hubble Space Telescope — WFPC2-PC in F555W wavelength.
- Used Python to investigate the dark matter mass distribution of early-type galaxies by applying a three dimensional luminosity density model and a novel functional total mass-to-light ratio as a function of radius.

National Cheng Kung University, Tainan, Taiwan

RESEARCH ASSISTANT, Jul. – Sep. 2011

- Used a software IDL to reanalyse a famous solar flare event called 'Bastille Day event' happened on 14 July 2000. This study supports the theoretical explanation of magnetic reconnection to the observation.

Teaching Experience

Department of Physics, Durham University, Durham, UK

- **Year 1 Laboratory Demonstrator, 2020** —
 - Weekly laboratory demonstration
 - Formative and summative report marking and feedback
 - Oral presentation examination and feedback
- **Supervision, 2021** —
 - V. Desai, 2022/2023, Master of Physics
 - T. M. Hehir, 2022/2023, Master of Physics
 - S. M. William, 2021/2022, Master of Physics, Class I (Honours)
 - A. Lowe, 2021/2022, Master of Physics, Class II Division 1 (Honours)

School of Physics and Astronomy, University of Nottingham, Nottingham, UK

- **Coursework Marker, 2017–2020**
 - PHYS1001 (F31CO1): From Newton to Einstein
 - PHYS1004 (F31QP1): Quantitative Physics

Institute of Astronomy, National Tsing Hua University, Hsinchu, Taiwan

- **Teaching Assistant for Summer Program in Astrophysics, Aug 2016**
 - The program included one-week lectures of general Astronomy and the tutorial of astronomical softwares, two-days observation at the Lulin Observatory, Taiwan, the tutorial of data analysis, and assessing final seminars.
- **Teaching Assistant, 2015 – 2016**
 - Compulsory course — ASTR610000: Observational Astronomy

Department of Physics, National Tsing Hua University, Hsinchu, Taiwan

- **Teaching Assistant, 2014 – 2016**
 - Optional course — PHYS317000: Numerical Analysis
 - Optional course — PHYS241000: General Astronomy (I)
 - Optional course — PHYS242000: General Astronomy (II)

Awards and Grants

Physics Department Award for Excellence	<i>Durham University</i> <i>United Kingdom</i> <i>Sep 2022</i>
The Alan Turing Institute Post- Doctoral Enrichment Awards	<i>The Alan Turing Institute</i> <i>United Kingdom</i> <i>2022</i>
Vice-Chancellor's Scholarship for Research Excellence (International)	<i>University of Nottingham</i> <i>United Kingdom</i> <i>2017 – 2020</i>
Graduate School Travel Prize	<i>University of Nottingham</i> <i>United Kingdom</i> <i>Sep 2019</i>

Conference/Meeting Travel Grants	<i>Royal Astronomical Society United Kingdom Aug 2019</i>
<ul style="list-style-type: none"> The prize supports researchers to attend national/international conference/meeting. 	
Kavli Student Fellow	<i>UC Santa Cruz United States Jul 2019 – Aug 2019</i>
<ul style="list-style-type: none"> Selected fellows for the Kavli Summer Program in Astrophysics 2019. Each fellow are provided accommodation and stipend during the period. 	
ASROC Special Award for Oral Presentation	<i>Astronomical Society ROC Taiwan 2016</i>
<ul style="list-style-type: none"> Awarded to an excellent postgraduate student at the Annual Meeting of the Astronomical Society in Taiwan (ASROC). 	
Hardship Funds (UG)	<i>NTNU Taiwan Sep 2012 – Jun 2014</i>
<ul style="list-style-type: none"> Financial support for top students studying in higher educational institutes. 	
Scholarship from the Physics department (UG)	<i>NTNU Taiwan 2010 – 2012</i>
<ul style="list-style-type: none"> Awarded to an excellent undergraduate each year. 	

Seminars and Conference

Mar 2023	Royal Astronomical Society (RAS) Specialist Discussion Meeting: Harvesting spectroscopic and time series data with ML/AI, RAS, Organiser	<i>London, UK</i>
Nov 2022	University of Manchester, Research Visit, Seminar Talk	<i>Manchester, UK</i>
Sep 2022	What matter(s) around galaxies 2022, Connecting the dots between the CGM and the larger-scale environment, Contributed	<i>Champoluc, Italy</i>
Jul 2022	National Astronomy Meeting (NAM), Royal Astronomical Society, Session Co-organiser	<i>Warwick, UK</i>
Jun 2022	European Astronomical Society (EAS) Annual Meeting, EAS, Contributed	<i>Valencia, Spain</i>
May 2022	National Chen Kong University, Physics Department, Seminar Talk	<i>Tainan, Taiwan</i>
Mar 2022	AI UK: UK's national showcase of artificial intelligence (AI) and data science research and collaboration, The Alan Turing Institute, Awardee Presentation	<i>Virtual</i>
Dec 2021	Australia National University, Colloquium, Seminar Talk	<i>Virtual</i>
Oct 2021	Debating The Potential of Machine Learning In Astronomical Surveys, Institut Astrophysique de Paris (IAP), Contributed	<i>Virtual</i>
Oct 2021	Artificial Intelligence for Science, Industry and Society (AISIS), National Autonomous University of Mexico (UNAM), Invited Speaker	<i>Virtual</i>
Jun 2021	238th Meeting of the American Astronomical Society (AAS), AAS, Invited Speaker	<i>Virtual</i>
Feb 2021	National Tsing Hua University, Institute of Astronomy, Seminar Talk	<i>Hsinchu, Taiwan</i>
Jan 2021	Durham University, Lunch Talk	<i>Virtual</i>
Jan 2021	Academia Sinica Institute of Astronomy and Astrophysics, Seminar Talk	<i>Taipei, Taiwan</i>

Oct 2020	University of California Santa Cruz, Machine Learning club, Seminar Talk	<i>Virtual</i>
Jul 2020	Kavil Summer Program Astrophysics Alumni Meeting, University of California Santa Cruz, Contributed	<i>Virtual</i>
Nov 2019	Dark Energy Survey Collaboration Meeting, University of Sussex, Contributed	<i>Sussex, UK</i>
Oct 2019	University College London, Astroparticle Seminar, Seminar Talk	<i>London, UK</i>
Oct 2019	University of Nottingham, Lunch Talk	<i>Nottingham, UK</i>
Mar 2019	University of Nottingham, Lunch Talk	<i>Nottingham, UK</i>
Mar 2019	Royal Astronomical Society (RAS) Specialist Discussion Meeting: Machine Learning and AI applied to Astronomy, RAS, Contributed	<i>London, UK</i>
Nov 2018	Royal Astronomical Society (RAS) Specialist Discussion Meeting: Dark Energy Survey: More than dark energy, RAS, Contributed	<i>London, UK</i>
Sep 2018	Machine Learning Applications for Astronomy, University of Nottingham, Contributed	<i>Nottingham, UK</i>
Jun 2018	Planning for Surprises in the era of Data-Driven Astronomy, University of Oxford, Contributed	<i>Oxford, UK</i>
May 2018	University of Nottingham, Lunch Talk	<i>Nottingham, UK</i>
May 2016	Annual meeting of the Astronomical Society in Taiwan, ASROC, Contributed	<i>Tainan, Taiwan</i>
Jan 2016	Annual meeting of the Astronomical Society in Taiwan, ASROC, Poster	<i>Kaohsiung, Taiwan</i>
May 2015	Annual meeting of the Astronomical Society in Taiwan, ASROC, Poster	<i>Ilan, Taiwan</i>

Academic Service & Volunteering

• Referee for peer-review Journals

<i>Journal Name</i>	<i>Impact factor</i>	<i>Number</i>
Monthly Notices of the Royal Astronomical Society	5.287 (2020)	3 papers
Astronomy and Computing	1.927 (2020)	2 papers
The Astrophysical Journal (ApJ)	5.847 (2020)	1 papers
Astronomy and Astrophysics (A&A)	5.802 (2020)	1 papers

• Academic Enrichment

Dark Energy Survey (DES) Organisation

- i) Co-convener of *Galaxy evolution & QSO* working group (newly assigned)

Astronomy and Computing (ASCOM)

- ASCOM is a peer-reviewed journal, published by Elsevier, that focuses on the broad area between astronomy, computer science, software development and information technology.
 - i) Early Career Researcher editorial board (newly assigned)

Taiwanese Young Researcher Association (Tyra)

- Project Tyra provides a platform for Taiwanese young researchers in diverse research fields, including social science, natural science, arts, etc, to share their experience and communicate with each other.
 - i) IT supports (April 2022–)
 - ii) Chair of weekly seminar (Oct 2022)

CAPT Lunch Talk Organiser, *University of Nottingham, Sep 2019 — Jul 2020*

- Organising weekly lunch talk for the Centre for Astronomy and Particle Theory (CAPT), University of Nottingham.

Student Union (Physics department), *National Taiwan Normal University, 2012 — 2013*

- i) Academic activity leader (2012-2013)
 - ii) Orientation event organiser (2012)
 - iii) Outreach activity leader of the Physics camp for 15-18y students (2011-2012)
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• EDI Activities

EDI group member, *CEA/ICC/CfAI, Durham University, 2022 —*

- *Durham IDEA* is a discussion group happening every four weeks to talk about, raise awareness, interact and share ideas about Integration, Diversity, Equity and Accessibility.
 - i) Organiser of annually PhD/ECR career activities (Jan 2022–):
 - Two events are planned to hold annually in June and October to help PhD/ECR explore their career options and assess career plan and development with seniors.
 - ii) Co-organiser of IDEA discussion sessions:
 - Imposter Symptoms (28 February 2022)
 - iii) Designer of the mental health awareness poster at Physics department (2021)

Audio book volunteer, *Foundation for the Blind in Taiwan, 2015 — 2016*

- Audio book recordings for visually impaired people.

Amanuensis, *Special Education Centre, National Taiwan Normal University, 2013 — 2014*

- Received a year training and licensed as Amanuensis
- Aid hearing impaired students in taking note and minute during lectures.
- Volunteer in diverse activities as amanuensis support for hearing impaired attendee

Care group for families of natural disaster victims, *2010 — 2011*

- Regularly visited families who had suffered from natural disasters such as typhoon and earthquake in the mountain. We delivered necessary goods and helped rebuilding their homes.
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• Outreach Activities

Talks:

- Talk for general audience at the Sunderland Astronomical Society (April 2023)
- Virtual Talk for general audience at CUNY Baruch College Forum (October 2022)
- Virtual Talk for general audience at CUNY Baruch College Forum (June 2022)
- Virtual Talk for general audience at TYRA (November 2021)

Digital Art Project, *Ogden@20 schools' day, Physics department, DU (Oct — Dec 2022)*

- We work with students of local school to make a film/piece for the Ogden@20 celebration at the Physics department.

NTNU Physics Camp, *Student Union of Physics, NTNU (2010—2014)*

- The summer and winter multiple-days Physics camps for 15-18y students were we conveyed the concept of Physics through a variety of activities.

Extracurricular Activities

Durham University Staff Volleyball Club

- Weekly casual volleyball play.

*Durham University
United Kingdom
2021 –*

Durham City Table Tennis Club

- Weekly casual table tennis play.
- 3rd of Team competition in the region league at County Durham (2021–2022)

*Durham City TT Club
United Kingdom
2021 –*

UoN Aikido Club

- Attended the Student Nationals at York in March 2019, and won the 3rd place in Embu – Randori no Kata. The female team has won the 2nd place among universities in the Randori.
- **Committee position: Treasurer for the year of 2019/20.**

*University of Nottingham
United Kingdom
Sep 2018 – Jun 2020*

Actor

- Acted several side roles in a play called “Night of the Souls”.

*The New Theatre, UoN
United Kingdom
Oct 2018 – Jan 2019*

Working Holiday in Canada

- Working holiday in Canada while applying my PhD position in 2016–2017.
- Spent 1.5 months travelling around Canada through railway.

*Canada
Oct 2016 – Jun 2017*

Actor

- Worked for the Apple Troupe as a part-time actor in two children plays.
- Our “Water Elf” play did a round trip at the primary schools in Kaohsiung City, Taiwan.
- We presented a play called “The Adventures of Spider” at a family-friendly activity held by the Taoyuan City Council, Taiwan.

*Apple Troupe
Taiwan
Sep 2016 – Oct 2016*

Actor

- Acted in a Taiwanese musical entitled “Taiwan as a Young Man – Jiji”.
- Our group was invited as visitor to an acting workshop at the Tsing Hua University in China. Acted in a play entitled “The Late Christopher Bean”.

*The Art Centres, NTHU
Taiwan
Mar 2016 – Sep 2016*

Female Volleyball Team Starter, Physics Department

- Our team has won the championship and the 2nd place at the Taiwan Universities Physics Cup in 2014 and 2015, respectively.

*NTHU
Taiwan
2014 – 2015*

Radio DJ

- Held an hour late-night weekly program.
- Held a 30-minutes Live dinner broadcast on every Wednesday.
- Organised a special interview with University Baseball team from both National Tsing Hua University and National Chiao Tung University for the sport competition – Mei-Chu Tournament between two universities.

*Tsing Hua Broadcasting
NTHU, Taiwan
2014 – 2016*

Female Volleyball Team member, Physics Department

- Had become one of the starter for the team since 2011.
- **Committee position: Vice president (2011); president (2012)**

*NTNU
Taiwan
2010 – 2014*

Cheerleader Team member, Physics Department

- Attended the cheerleader competition for fresher at NTNU

*NTNU
Taiwan
2010*