Collaboration for Universities of Taxes System and University Academic Alliance in Taiwan

Call for proposal -- details discussion

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Vice President, National Taiwan University of Science and Technology

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outline

1. Collaboration initiatives
2. UAAT members and current collaboration targets
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Collaboration Initiatives

- Taiwan's Ministry of Education (MOE) proposed "Promoting International Cooperation Through University Alliances and Planning for International Student Recruitment," which marked the beginning of a new chapter in the history of international cooperation and exchange. So, University Academic Alliance in Taiwan (UAAT) is formed.
- This project is an initiative of UAAT, focused on research and talent cultivation in the field of semiconductor after the discussions with Universities of Taxes System (UTS).

Collaboration Initiatives

- Multiple member universities of UAAT are participating in this project, aiming at attracting distinguished international scholars and foreign students to Taiwan through bilateral academic cooperation and exchange.
- Simultaneously, it also hope to send domestic teachers and students abroad to foster local academic talent.

UAAT members

- National Taiwan University
- National Cheng Kung University
- National Tsing Hua University
- National Yang Ming Chiao Tung University
- National Sun Yat-sen University
- National Taipei University of Technology
- National Chengchi University
- National Chung Hsing University
- National Central University
- National Taiwan Normal University
- Taipei Medical University
- National Taiwan University of Science and Technology

Current Collaboration Targets in UAAT

- Universities of Illinois (UI), USA
- University of Taxes System (UTS), USA
- Taxes A&M Universities (TAMUS), USA
- ICU, Czech
- Kyushu Okinawa Open Univeristy (KOOU), Japan

We expect to have more collaboration in the future.

Already having match funding from UI system for this collaboration

Some topics for collaboration with UTS

Interested professors, please directly check with the contact professors or PI.

This slide file and the recorded seminar will be put on the website announced later.

Possible topics

Contact: Prof. Weidong Zhou
UTA-1: Devices and architectures for high-dimensional entanglement
(Area 4: Quantum computing/communications/information)
PI: Prof. Michael Vasilyev, Photonics Center and Department of EE, UT Arlington
DESCRIPTION: We will develop photonic devices and architectures for generation, distribution, and manipulation / processing of high-dimensional entangled states for applications in quantum computing, communication, and sensing. This work builds upon our existing research on using polarization, frequency / temporal, and spatial modes to scale quantum communication and processing capacity, supported by the Quantum Testbed at the UT Arlington.

Possible topics

UTA-2: Photonic crystal optoelectronics for quantum photonics
(Area 5: Quantum & Nanophotonics)
PI: Prof. Weidong Zhou, Photonics Center and Department of EE, UT Arlington
DESCRIPTION: We are developing high power semiconductor photonic crystal surface emitting lasers (PCSELs) and high-speed photonic crystal spatial light modulators (PCSLMs) for integrated quantum photonic chips. These are currently funded by US Department of Defense. We hope to establish collaborations in materials, designs, and heterogeneous integration with our counterparts in Taiwan.

Possible topics

UTA-3: Advancing 1.55 µm Single-Photon Detectors for Quantum Technology (Area 5: Quantum & Nanophotonics)
PI: Prof. Seunghyun (Jacob) Lee, Photonics Center and Department of EE, UT Arlington
DESCRIPTION: We are planning to develop highly sensitive photodetectors using avalanche photodiodes (APDs), designed for single-photon detectors. Our research focuses on an integrated design approach that combines electronic engineering with photonic engineering to create advanced APDs. The design, fabrication and characterization of the APDs will be performed using facilities at UT Arlington. We aim to establish collaborations in material development and heterogeneous integration with our counterparts in Taiwan.

Possible topics

Contact: Massimo Fischetti

UTD-1: Materials for Future VLSI

(Covered under the Anstrom Semiconductor Initiative)

PIs: Profs. KJ Cho, William Vandenberghe, Chadwin Young, Massimo Fischetti

DESCRIPTION: We propose to study new two-dimensional (2D) materials with possible applications to the scaling of electron devices for future technology nodes. Professor Cho is an expert *in ab initio* calculations (density functional theory, DFT) that can be used to study the structural, mechanical, electronic, optical, and magnetic properties of these materials (as well as their growth). Professors Vandenberghe and Massimo combine the use of such DFT calculations to study theoretically electronic transport in these materials and to simulate the performance and characteristics of field-effect transistors (FETs) below the 10 nm scale, together with the physics of the electrical contacts that must be made to these materials. Finally, professor Young is an expert in the electrical characterization and reliability of electron devices and adds an experimental aspect to the effort.

Possible topics

Contact: Eric Brey

UTSA-1: Light-speed LLM at Minimal Energy Cost with Next-generation Silicon Photonics

DESCRIPTION: The wide adoption and large-scale compute cost of Large Language Models (LLMs), e.g., Vision Trans- formers, have called for efficient hardware accelerators. While traditional CMOS accelerators are being commonly deployed , there is a rising trend of utilizing silicon photonics (SiPh) as a promising alternative owing to its ultralow power consumption and light-speed processing capability. There have been limited attempts at using SiPh for designing AI accelerators that operate with hardcoded weight matrices (e.g. CNN inference). However, such designs fail to perform LLM-like models due to their highly dynamic attention mechanism. In this collaborative effort, I plan to pursue a codesign approach going from photonic device modeling to full-scale photonic system optimization to realize next-generation all-photonic LLM accelerator specifically for time-critical and resource constraint scenarios such as healthcare and remote sensing.

Possible topics

UTSA-2: Improving Semiconductor Manufacturing through a Lean AI Paradigm: An AI-aided Lean and Smart System for Semiconductor Production Considering Green and Sustainable Measures

DESCRIPTION: Integrating Lean Manufacturing tools with artificial intelligence (AI) is emerging as a revolutionary approach to optimize production processes, reduce waste, and enhance efficiency. Traditional Lean practices focus on waste reduction and process improvement, often relying on human expertise for problem identification and resolution. AI algorithms, on the other hand, excel in pattern recognition, data analysis, and decision-making. Lean tools and AI can offer more precise, data-driven solutions for common manufacturing challenges when integrated. AI algorithms can automate and refine Lean techniques like value stream mapping, Kanban, and 5S by providing real-time, actionable insights drawn from big data. This fusion of Lean and AI aids in predictive maintenance, quality control, and optimization, enhancing the efficiency and responsiveness of the manufacturing process, and addressing important green and sustainable measures. Moreover, AI's capability for machine learning allows the system to adapt and improve autonomously over time, further aligning with Lean's continuous improvement ethos.

Possible topics

UTAT-1: Physical design for advanced packaging
(Area 1: Advanced VLSI)
PI: Prof. David Z. Pan, Department of ECE, UT Austin; Prof. Shao-Yun Fang, EE, NTUST
DESCRIPTION: Physical design in advanced packaging and heterogeneous integration involves integrating multiple semiconductor devices into a single package to improve performance, power, and area (PPA). Key techniques include 3D integration for vertical stacking, 2.5D integration using interposers for high-density interconnects, and Fan-Out Wafer-Level Packaging (FOWLP) for compact designs. System-in-Package (SiP) and chiplet-based designs allow modular integration of diverse functionalities. Advanced interconnects, such as high-density interconnects (HDI) and micro-bumps, facilitate die-to-die connections. Embedded die packaging, advanced materials, and efficient thermal management improve electrical performance and reliability. These techniques enable the creation of powerful, efficient, and compact electronic systems, meeting the demands of modern applications.

Possible topics

UTAT-2: Heterogeneous integration and hardware/software co-design for AI acceleration
(Area 1: Advanced VLSI)
PI: Prof. Diana Marculescu (Department Chair), Department of ECE, UT Austin;
Prof. Shao-Yun Fang, EE, NTUST
DESCRIPTION: To strengthen the need for 2.5D/3D integration of multiple semiconductor devices, specific applications such as computer vision (CV) and natural language processing (NLP) are widely discussed. These applications usually involve massive amount of data exchange between computing/memory units, necessitating high-speed communication that can be realized by 2.5D/3D integration. In addition to aforementioned intrinsic characteristics of CV and NLP applications, accelerating these applications may further uplift the communication requirement and thus make it imperative to develop advanced integration and packaging techniques. The synergy between advanced integration/packaging techniques and CV/NLP acceleration approaches is also a highly challenging topic to be addressed.

Possible topics

Contact: **Prof. Hsiu-Yang Tseng (Department of Mechanical Engineering, NTUST)**
Project Type: Research
Title: Advancing nanoscale wet etching efficacy in semiconductor fabrication
As semiconductor miniaturization pushes technological limits, refining manufacturing processes, such as wet etching, is crucial in the competition for higher yields and performance. In this project, we target the improvement of delivery of etchants and consequent removal of etching by products in nanoscale features. Focused on optimizing the hydrodynamic boundary layer at the liquid-solid interface by introducing electroosmotic flow pumping, this approach aims to enhance the precision of etching nanoscale features, contributing to more effective wafer processing and reliable semiconductor devices.

Possible topics

Project Type: Talent Cultivation/Exchange
Title: Academic activities and a short course for semiconductor manufacturing process, equipment, and measurement technology
We plan to open a short course introducing semiconductor equipment for manufacturing and measurement purposes, such as vacuum, thin film, plasma, photolithography, chemical mechanical polishing, electrical discharge machining, packaging, and precision measurement. Academic activities and exchange programs between UAAT and UTS will also be arranged.
Contact: **Prof. Ming-Jyh Chern (Department of Mechanical Engineering, NTUST)**

3 聯盟「整合型計畫提案方式與程序」草案及計畫書格式

國家重點領域國際合作聯盟整合型計畫提案方式與程序

(草案)

一、整合型計畫推動目的

整合型計畫是針對國家重點領域國際合作聯盟(以下簡稱 UAAT)簽署 MOU 範圍內，擇定特定領域(如半導體、農業等)推動的研究與人才培育計畫，並由 UAAT 多所成員學校參與執行，期待經由雙邊的國際學術合作與交流，達到吸引國際優秀學者與外國學生來臺交流之目的；同時選送國內教師與學生赴國外交流，培育國內學術人才。

二、整合型計畫組成

整合型計畫應由 2 項以上子計畫構成，各項子計畫之間須具有關聯性，每一整合型計畫至少要有 4 所 UAAT 成員學校參與。子計畫可以分成「研究計畫」與「人才培育計畫」兩種類型；並由 UAAT 聯席會議決議之召集學校進行統籌規劃與整合。

子計畫類型	研究計畫	人才培育計畫
參與校數要求	2 校(含)以上	2 校(含)以上
執行活動類型	➢ Graduate exchange programs ➢ Short-term courses ➢ Intensive courses/workshops ➢ Overseas research ➢ Academic conferences/professional activities ➢ Dual/joint degrees ➢ Joint research ➢ International industry-academia collaboration program	

You can get them from our website

Overall Project 總計畫

International Integrated Collaboration Project for

(Please fill in the collaborating international alliances/systems)

& University Academic Alliance in Taiwan (UAAT)

國家重點領域國際合作聯盟領域整合型計畫

（請填入合作的國際聯盟/系統）

Project Title: (English)_____

(Chinese)_____

Coordinating University 召集學校:

UAAT: _____

Please fill in the collaborating international alliances/systems: (Please Fill in the Partner University)

Project Period: MM/DD/YYYY to MM/DD/YYYY

Application Date: MM/DD/YYYY

- **Research Areas**: Semiconductor
- **Types of Projects**: "Research Projects," "Talent Cultivation Projects," or "Compounded Projects."
- **Collaborating International Alliance**: The University of Texas System (UTS).
- **Funding Recipients**: Research and teaching personnel from UAAT member universities. Each project must involve at least two UAAT member universities.
- **Funding Period**: Projects should commence no later than December 1, 2024, with a duration of one year, and it must be completed by the end of 2025.
- **Application Period**: The coordinating university, NTUST, will accept applications from now to August 10, 2024. Afterward, NTUST will handle the overall planning and coordination, submitting the proposals to the UAAT joint meeting for confirmation. The secretariat (National Taiwan University) will then forward them to the Ministry of Education for review by September 25, 2024.
- **Funding Amount**: Each subproject if approved by the MOE, will be funded with a principle amount of NT$2,000,000 to NT$3,000,000.
- **Contact Person**: the NTUST counter parties should report Miss Kuo from the Academic Collaborative Center, Office of Research and Development, contact number (02)2733-3141 ext. 7546, email: Kcc1031@mail.ntust.edu.tw; the UTS counter parties should report to the UTS representative, Joan Bienvenue, email: jbienvenue@utsystem.edu, for their participation in the proposal.

Types of Projects	Research Projects	Talent Cultivation Projects	Compounded Projects
Number of Participating UAAT members Requirement	At least 2 UAAT members	At least 2 UAAT members	At least 2 (better 4) UAAT members
Types of Activities	➢ Graduate exchange programs ➢ Short-term courses ➢ Intensive courses/workshops ➢ Overseas research ➢ Academic conferences/professional activities ➢ Dual/joint degrees ➢ Joint research ➢ International industry-academia collaboration program		

Possible Information required for the Proposal:

Sub-Project Description (not limited to)

- Background Introduction and Importance of the Sub-Project;
- Project Objectives, Plans, and Activities;
- Project Teams, Organization, and Synergies (including roles and participation of young scientists);
- Milestones and Timelines; Expected Outcomes and Impacts (including the promotion of talent circulation /exchange);
- Intellectual Property Management;
- Possible Future Collaboration Development (e.g., develop into large-scale projects, industry-academia collaboration, talent cultivation, international projects, joint research center/consortium, etc.)

For details, please refer to the attached CFP.

Possible Information required for the Proposal:

Expected Outcomes for the Sub-Project

- Joint Research Activity
- Students and Faculty Exchange
- Internship Programs
- Short-Term Courses/Intensive Courses/Workshops & Academic Conferences/ Professional Activities
- International Industry-Academia Collaboration
- Any possible research collaboration

Possible Information required for the Proposal:

Budget

- Personnel
- General Expenses (Local Collaboration Research Expenses; Local Collaboration Activity Expenses)
- International Travel Expenses
- Equipment
- Overhead

For details, please refer to the CFP. Also, we may make some suggestions after the first round of review.

Matching Service
(First round of review)

- During this process, NTUST, as the coordinating university for UAAT will provide matching services to institutes that have not yet found partners for their projects. (send us related materials before Aug. 10)
- While UAAT will make every efforts to assist UTS member teams in finding matches with UAAT member teams, and vice versa, successful matching cannot be guaranteed.

Not strict deadline, just for easy to coordinate.

NTUST contact window: Shun-Feng Su (Vice president, NTUST) sfsu@mail.ntust.edu.tw
Miss Kuo (assistant for research and development) Kcc1031@mail.ntust.edu.tw
UTS contact window: Joan Bienvenue (associate vice chancellor) jbienvenue@utsytems.edu

Important dates

Proposal Submission stage (the first round of review)

08/10 Deadline for Proposal Submissions

08/25 Acceptance Decision

Will be evaluated and integrated by NTUST. All decisions will be performed by outside reviewers

Funding Application stahe (actual review)

09/05 Team Formation for the Integrated Project and Joint Drafting of the Integrated Project.

09/20 Completion of the Joint Project.

09/23 Submission to UAAT and further forwarded to MOE.

Will be evaluated and integrated by MOE, Taiwan.

Questions and Discussions

Thank You !