文號：1150016242

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便簽 日期：115年7月28日
單位：研究發展處

速別：普通件
密等及解密條件或保密期限：

一、文陳閱後，公告於電子公佈欄、本組、本處及本校最新消息，並e-mail副知全校教師知照。
二、請計畫主持人於115年10月2日前於國科會系統完成線上申請作業，線上繳交送出即可，無須經由申請機構線上送出。
三、文存。

會辦單位：

第二層決行		
承辦單位	會辦單位	決行
行政組員 張明芬 0728 1154		代為決行

國立中興大學
研究發展處　1150016242

檔　　號：
保存年限：

國家科學及技術委員會　函

機關地址：臺北市和平東路二段106號
聯絡人：徐文章　研究員
電話：02-2737-7522
傳真：02-2737-7465
電子信箱：wenchsu@nstc.gov.tw

受文者：國立中興大學

發文日期：中華民國115年7月27日
發文字號：科會自字第1150052645號
速別：普通件
密等及解密條件或保密期限：
附件：如文(附件1 115M0P000507_115D2021858-01.pdf、附件2 115M0P000507_115D2021859-01.pdf、附件3 115M0P000507_115D2021860-01.pdf)

主旨：本會116年度「臺美奈米材料基礎科學研發共同合作研究計畫」構想書，徵求期間自115年7月31日起至115年10月2日止，逾期不予受理，請查照轉知。

說明：

一、構想書(Pre-Proposal)審查獲推薦者，將行文通知申請人提送具體計畫書(Full-Proposal)。本計畫之執行期程為3年，預計自116年8月1日開始至119年7月31日止，以本會實際核定通過日期為準。

二、申請人請循本會「專題研究計畫/(構想書計畫類別)臺美奈米材料基礎科學研發共同合作研究計畫構想書」線上申請方式作業，線上繳交送出即可，不須經由申請機構造具名冊及線上送出。徵求公告與其附件可至本會自然科學及永續研究發展處網頁(http://www.nstc.gov.tw/nat/ch)之公告事項下載。

三、有關系統操作問題，請洽本會資訊系統服務專線，電話(02)2737-7590、7591、7592。

正本：專題研究計畫受補助單位（共255單位）
副本：本會綜合規劃處、自然處 115/07/27 16:49:23

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國立中興大學

1150016242　115/07/27

主任委員吳誠文

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Pre-proposal of Taiwan/USAF Program on Nano-Structured Materials for Sensing and Sustainment

I. General Information

Scope	☐ **AI-driven materials discovery** ☐ **Materials and nanostructures for energy-efficient electronic, photonic, and quantum information technologies** ☐ **Quantum geometry in solids**
	3 Keywords:____________________________________
Project Period	From 08/01/2027 to 07/31/2030 (MM/DD/YYYY)

Research Project Title	English	
	Chinese	

Taiwan Researcher		Name		Institution / Department	
		Chinese	English	Chinese	English
	PI				
	co-PI 1				
	co-PI 2				

		First Year(/TWD)	Second Year(/TWD)	Third Year(/TWD)
Taiwan Researcher	Requested Funding			

USA Researcher		Name	Institution / Department
	PI		
	co-PI 1		
	co-PI 2		

		First Year(/USD)	Second Year(/USD)	Third Year(/USD)
USA Researcher	Requested Funding			

II. Contents

1. **Project Description, including:** research highlights, problem, method of investigation, uniqueness of approach, potential applications. **(Do not exceed 3 pages)**
2. **Additional Information:** Biographic Information on Taiwan and US Research Team Members and simple budget. (This does not count in the number of pages)

Call for Proposals
AFOSR-Taiwan NSTC Frontiers in Materials and Nanostructures: AI-Driven Discovery, Quantum Geometry, and Energy-Efficient Information Technologies
2027-2030

The US Air Force Office of Scientific Research (AFOSR) and Taiwan's National Science and Technology Council (NSTC) announce the solicitation for a three-year program entitled "Frontiers in Materials and Nanostructures: AI-Driven Discovery, Quantum Geometry, and Energy-Efficient Information Technologies."

History:
The US Air Force-Taiwan Nanoscience Program is one of the Air Force Office of Scientific Research's (AFOSR) International Research Initiatives. This international program is focused on shaping the direction and advancing the state-of-the-art in nanoscience research. Starting in 2002, grants were provided to Taiwan investigators to focus on basic research in specific nanoscience areas of interest as described by program managers at AFOSR or at the Air Force Research Lab (AFRL). In 2011 the program evolved to become a collaborative effort to pair US and Taiwan investigators to conduct basic science research on topics of common interest. In order to continue to provide opportunities for scientists to collaborate in emerging technology areas and to leverage their intellectual resources, AFOSR and NSTC are offering a new program dedicated to frontiers in materials and nanostructures in a variety of topic areas.

Eligibility:
This is an open call with open competition; therefore, all applications are welcome. Initial applications (pre-proposals) must have two investigators - one from a US institution or DoD Lab, and one from a Taiwan institution. Teams consisting of a US investigator and his/her counterpart from Taiwan are invited to submit a joint pre-proposal (white paper) indicating what their collaboration could accomplish with three years of funding. Each US-Taiwan pair is to submit only one pre-proposal. The same pre-proposal is to be submitted to both AFOSR and NSTC.

Scientific Topics:
Expected outcomes are that basic scientific research funded under this program will have results published in the open literature, will complement existing basic and applied research efforts at AFRL and NSTC, and will foster greater scientific collaborations between the US and Taiwan at the investigator level. The scientific focus will be on frontiers in materials and nanostructures that can advance science in the following concentration areas:

1. AI-driven materials discovery: We seek fundamental studies that integrate artificial intelligence, physics-based modeling, and experimental feedback to accelerate the discovery, synthesis, and understanding of solid-state materials, nanostructures, interfaces, molecules, and hybrid systems. Rather than purely data-driven screening or incremental database mining, this call emphasizes physically interpretable, uncertainty-aware, and experimentally validated approaches that reveal structure-property-function relationships across unexplored chemical, structural, and processing spaces. These efforts should enable predictive design of materials with targeted functionalities. Proposals are expected to align with one or more of the following core research tracks:

* **Physics-informed AI and quantum-level modeling:** Proposals may integrate machine learning with ab initio electronic-structure methods, quantum chemistry, molecular dynamics, many-body theory, or multiscale simulations to improve the accuracy, transferability, and efficiency of materials prediction. Emphasis should be placed on physically constrained and interpretable models that can predict key material properties while revealing the underlying structure–property relationships.

* **Predictive discovery, inverse design, and synthesis optimization:** Proposals may develop AI-guided approaches to identify stable or metastable materials, molecules, nanostructures, defects, interfaces, and heterostructures with targeted properties. Particular emphasis should be placed on uncertainty quantification, synthesis-aware design rules, closed-loop optimization, and experimentally testable predictions.

* **AI-enabled multiscale modeling of complex materials:** Proposals may leverage AI to bridge atomistic, mesoscale, and continuum descriptions of heterogeneous, disordered, interfacial, or nonequilibrium systems, including complex solids, molecular assemblies, low-dimensional heterostructures, multifunctional interfaces, and nanostructures whose properties emerge across multiple length and time scales.

2. Materials and nanostructures for energy-efficient electronic, photonic, and quantum information technologies: High energy demand driven by the rapid development of artificial intelligence represents a major challenge, making sustainable computing infrastructure highly desirable. We seek innovative materials and nanostructures that enable high-performance, low-power operation across computation, memory, data storage, optical interconnects, photonic or optoelectronic information processing, and emerging quantum information functionalities. Rather than system-level optimizations or conventional CMOS iterations, this call targets the synthesis, deterministic manipulation, and microscopic characterization of novel material phases, low-dimensional heterostructures, functional interfaces, and nanoscale photonic structures engineered to approach fundamental limits of energy-efficient information processing. Emphasis should be placed on material mechanisms, interfacial phenomena, nanoscale control, and experimentally measurable physical observables relevant to energy-efficient information processing.

3. Quantum geometry in solids:

Quantum geometry describes how electronic wavefunctions evolve in momentum space and governs emergent properties of solids, including topological and anomalous transport, nonlinear optical responses, and flat-band superconductivity. We seek scientific breakthrough to advance our understanding of quantum-geometric responses in materials. These efforts may guide the prediction and realization of new materials with enhanced emergent properties, potentially including robust high-temperature topological states. Proposals are expected to align with one or more of the following core research tracks:

* **Advanced Experimental Methodologies to Resolve Quantum Geometry**: We seek new experimental methodologies to resolve quantum geometry in crystalline solids.

Applicants are encouraged to extend these approaches to broad classes of quantum materials, such as topological materials, flat-band systems, moiré heterostructures, and superconductors. Methods that quantitatively isolate intrinsic Berry curvature and quantum metric contributions from conventional or extrinsic background responses, and benchmark experimental results against realistic first-principles or model calculations are desirable.

* **Novel Theoretical Frameworks Beyond DFT**: We seek new theoretical frameworks in which quantum geometry serves as a central descriptor of solids, complementing conventional band dispersion, symmetry, and Fermi-surface-based descriptions. Such frameworks should address realistic multiband, strongly correlated, disordered, and many-body systems, including, where relevant, interband mixing, electronic interactions, finite quasiparticle lifetimes, and non-translational configurations through Green's-function, diagrammatic, or kinetic approaches. They should clarify how quantum geometry governs nonlinear optical responses, transport, superconductivity, and collective phases, while providing experimentally testable criteria for separating intrinsic quantum-geometric effects from extrinsic contributions. The ultimate goal is to establish predictive design principles for quantum materials with enhanced novel functionalities.

Further information about areas of interest can be found in the AFOSR Broad Agency Announcement (FA9550-26-S-0001) at https://www.grants.gov/search-results-detail/362681.

Funding Level:
AFOSR will fund the selected US investigators. Available funding for the selected set of US projects is $1,200,000 per year for three years. The examples listed are based on 8 funded projects; the final amounts to be allocated will be determined by the final number of team awardees. NSTC will similarly fund the selected Taiwan investigators.
Year 1 (2027-2028) – up to $150,000 for US PIs
Year 2 (2028-2029) – up to $150,000 for US PIs
Year 3 (2029-2030) – up to $150,000 for US PIs

Application Process, Timeline, and Submission Information
Pre-proposal (white paper) Phase: Each team consisting of a US PI and a Taiwan PI are to submit a joint pre-proposal (white paper). The technical narrative should be no more than three (3) pages and should include basic content such as problem statement, hypothesis, method of investigation, uniqueness of approach, and potential payoff. The following two items should be included as appendices (not counted against page count): biographic information on Taiwan and US research team members and simple budget.

Pre-proposals should be submitted via email to AFOSR Points of Contact (POC):
Lt Col Alexander Kamrud, alexander.kamrud.1@us.af.mil
and to the NSTC online system by **2 October 2026**.
Applicants in Taiwan can direct the questions to the NSTC POCs:
Dr. Tien-Ming Chuang, chuangtm@gate.sinica.edu.tw
Dr. Ian Liau, ianliau@nycu.edu.tw

All received pre-proposals will be reviewed independently by AFOSR and NSTC representatives. Evaluation criteria will include the scientific merit of the proposal, the unique synergy enabled by the US-Taiwan team, and the potential for transition to systems with AFRL and NSTC interest. Up to twenty (20) investigator pairs will be invited to submit full proposals. The selection of the research teams recommended to submit full proposals will be announced by **15 January 2027**.

Full Proposal Phase: Based on the technical content of the selected pre-proposals (white papers), full proposals will be developed independently by the US and Taiwan PI and submitted to their respective agency, AFOSR or NSTC, following the procedures of that agency. The full proposal should include a technical narrative of no more than eight (8) pages and expand on the ideas set forth in the pre-proposal to include a detailed plan of study. Though the full proposals will be submitted independently, each one should explain how collaboration with the counterpart from Taiwan or the US would create synergy and increase the potential for scientific breakthroughs beyond what could be accomplished separately. Investigator CVs and a detailed budget should be appended (not counted against page count). Full proposals will be due by **19 February 2027**.

US PIs: If your pre-proposal is selected for the full proposal phase, you will be provided with a template package and instructions at that time. Full proposals are to be submitted through the funding opportunity FA9550-26-S-0001 at grants.gov (https://www.grants.gov/search-results-detail/362681), Asian Office of Aerospace Research and Development (AOARD), PKG00293126. The evaluation of full proposals will be made independently by AFOSR and NSTC representatives. The announcement for the awards will be made by **30 April 2027**. Applicants funded by the AFOSR are subject to the terms and conditions described in the current AFOSR Broad Agency Announcement. Evaluation criteria and review are subject to the terms and conditions described in the current AFOSR Broad Agency Announcement. The approximate starting time for the selected projects is **October 2027**, and the period of performance will continue for three years until approximately **October 2030** (actual dates will depend on the Grant award process).

Funded investigators are expected to attend joint annual program reviews and present research progress. Though subject to change, the intent is to alternate program review locations between Taiwan and the US. Annual and final reporting requirements for US PIs are in accordance with AFOSR Grant policy.

「臺美奈米材料基礎科學研發共同合作研究計畫」
構想書徵求公告

(AFOSR-Taiwan NSTC Frontiers in Materials and Nanostructures:
AI-Driven Discovery, Quantum Geometry, and Energy-Efficient Information Technologies)

一、計畫目標

臺灣與美國空軍之奈米材料基礎科學國際合作計畫，係為臺灣與美國研究人員提供交流與合作的平台，藉此能夠了解國際研究趨勢，及激發奈米科學最新技術，臺美雙方於 107 年以同步公開徵求與各自補助計畫的方式開始進行合作。現在公開徵求 116 年度新的三年期雙邊合作計畫。

本徵求公告之訂定日期時間係以臺灣時間為準。

二、申請條件

(一) 計畫主持人與共同主持人之資格，須符合「國科會補助專題研究計畫作業要點」相關辦法之規定。申請機構須為本會專題研究計畫之受補助機關。本計畫歸屬「雙邊協議專案型國際合作研究計畫」件數，不列入本會研究計畫件數的額度計算，惟以 2 件為限。

(二) 合作對象：**需包含 1 個(含)以上的美方研究人員**。該美方研究人員之服務機構，必須為美國學術研究單位或美國國防部(DoD)之受補助實驗室。如對美方研究人員資格有疑問，請與本案美方負責人員聯絡。美國空軍聯絡人 AFOSR Points of Contact (POC):

Lt Col Alexander Kamrud, alexander.kamrud.1@us.af.mil

三、徵求內容

The scientific focus will be on frontiers in materials and nanostructures that can advance science in the following concentration areas:

1. AI-driven materials discovery: We seek fundamental studies that integrate artificial intelligence, physics-based modeling, and experimental feedback to accelerate the discovery, synthesis, and understanding of solid-state materials, nanostructures, interfaces, molecules, and hybrid systems. Rather than purely data-driven screening or incremental database mining, this call emphasizes physically interpretable, uncertainty-aware, and experimentally validated approaches that reveal structure-property-function relationships across unexplored chemical, structural, and processing spaces. These efforts should enable predictive design of materials with targeted functionalities. Proposals are expected to align with one or more of the following core research tracks:

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四、申請流程與注意事項

1. 申請流程：本計畫申請區分「構想書(Pre-proposal/whitepapers)」及「完整計畫書(Full-proposal)」兩階段，由臺美雙方共同審查。**臺美合作雙方之申請人，必須個別向其補助機構(本會和美國空軍辦公室)依規定，分別同時提交內容相同之構想書內容，僅有一方提出申請，視同申請資格不符。**
2. 構想書格式：如附件，且每位申請人(/計畫主持人)**以申請 1 件為限**。
3. 計畫執行期限：民國 116 年 8 月 1 日至 119 年 7 月 31 日，共 3 年。
4. 經費編列注意事項：計畫主持人配合臺方與美方之相關規劃，進行年度或期末成果簡報致使產生業務費、國外差旅費等相關支出，由該計畫經費項下勻支，不得另案再向本會申請。
5. 構想書申請期限及送達方式：請循本會「專題研究計畫／(構想書計畫類別)臺美奈米材料基礎科學研發共同合作研究計畫構想書」線上申請方式作業，申請截止日期為 **115 年 10 月 2 日(含當日)**。
   臺方申請人於系統繳交送出後，顯示「計畫狀態：繳交送出(國科會)」。**確定個人繳交送出即完成申請，構想書階段不需要經由申請機構之研發處送出，不需要申請機構造冊送國科會。**

美方申請人必須依據附件二，依規定以電郵件方式，將構想書寄送 AFOSR Points of Contact (POC):
Lt Col Alexander Kamrud, alexander.kamrud.1@us.af.mil

6. 構想書審查方式：確定臺美雙方之申請人皆符合申請資格後，如有必要，申請人需至本會進行簡報並接受詢答，經通知未進行簡報者，其申請案不予推薦。本計畫經費係專款專用，無申覆機制。
7. 審查重點：
   - 研究內容必須具有創新性，著重於基礎科學原創性研究。
   - 雙邊合作的必要性。
   - 具發展潛力及未來性。
8. 構想書審查結果通知：構想書審查獲推薦者，將由本會自然處正式行文通知申請機構與申請人於期限內，提送完整計畫書(Full-proposal)，由申請機構造具名冊備函送達本會。通知日期依實際審查作業情形為準。

六、成果報告繳交、審查及評鑑

計畫主持人除依本會規範繳交研究成果等報告外，應於全程期末配合本會辦理成果審查等計畫評鑑作業。計畫主持人亦須配合臺方與美方之相關規劃，進行年度或期末成果簡報。

七、附件：可至本會自然處公告事項(https://www.nstc.gov.tw/nat/ch)下載

(1) 臺方構想書格式
(2) 美方徵求公告

八、聯絡資訊

本會自然處
奈米共同召集人 Dr. Tien-Ming Chuang(莊天明), chuangtm@gate.sinica.edu.tw
徐文章研究員或王心頎小姐，Tel：02-2737-7522。