APPLICATION FOR LECTURER / SENIOR LECTURER IN MATERIALS SCIENCE AND ENGINEERING · MONASH UNIVERSITY

Response to Selection Criteria

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SUMMARY

I am a computational materials scientist with a PhD in Materials Science and Engineering from Monash University and nine years of postdoctoral research experience, including tenure with the ARC Centre of Excellence in Future Low-Energy Electronic Technologies (FLEET). My research focuses on thin-film magnetic and quantum materials, reflected in a refereed publication record of more than 40 papers, including 14 published since 2024, six of them in journals with an impact factor above 10. Alongside this, I have established a strong record of competitive research funding, contributing to grants totaling more than A$3.4 million since 2024, including Australia's Economic Accelerator (AEA) Ignite and ARC Linkage Projects as Lead CI or Key Participant, and translating my research into industry through a U.S. patent application. I have also taught computational materials science at both undergraduate and postgraduate levels, designed a comprehensive 12-week course from first principles, and mentored nine PhD candidates. Throughout my career, I have maintained close and collegial working relationships across departments, institutions, and industry partners, supporting collaborative research, education, and research translation.

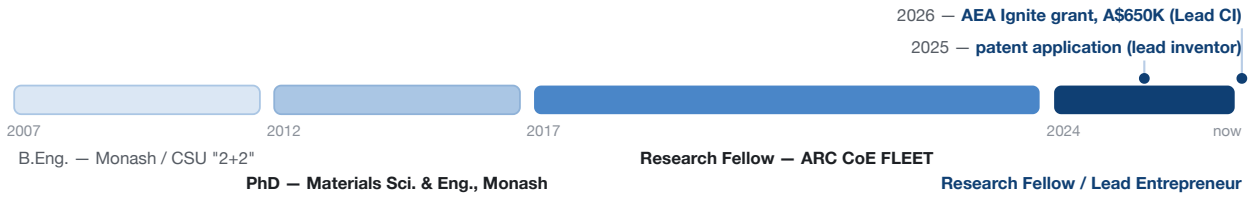
1 *The appointee will have a doctoral qualification in Materials Engineering, Chemistry, Physics or Chemical Engineering.*

RESPONSE

I hold a PhD in Materials Science and Engineering from Monash University. My research experience and current research interests have consistently focused on atomically thin-film materials, quantum materials, and the development of innovative computational approaches to accelerate advances in low-energy electronics.

My education and research experience have seen me grow from a student receiving rigorous academic training in Australia's top Materials Science and Engineering department into a competent and independent researcher who can deliver exceptional and innovative research outputs and engage with academic personnel at various levels. My interpersonal and leadership skills have sharpened significantly over the last few years, leading to success in publishing high-impact research papers, securing grants, and building connections with new industry partners.

CAREER AT A GLANCE



KNOWLEDGE AND SKILLS

KNOWLEDGE & SKILLS PROFILE — THE TOOLKIT BEHIND THE RESPONSES THAT FOLLOW

THIN-FILM MATERIALS

- Heusler alloy thin films (Co_2MnX, X = Ga, Ge)
- Amorphous magnetic thin films
- Berry curvature & spin-wave engineering
- Bismuth thin-film allotropes

QUANTUM MATERIALS

- Topological pyrite-type materials
- Phonon–topology interactions
- Quantum metric phenomena
- Magnetic topological insulators

OTHER SPECIALIZED RESEARCH SKILLS

- Density functional theory (DFT)
- Tight-binding & Wannier modeling
- Quantum transport & device modeling
- Large-scale HPC (NCI & Pawsey; >5M SU as Lead CI)

TEACHING & SCHOLARLY ACTIVITIES

- University teaching & curriculum design
- PhD supervision (9 candidates)
- Manuscript preparation & grant writing
- Peer review & research translation

2 *Possess a high level of interpersonal skills and demonstrated ability to work independently and as part of a team across both the education and service sectors.*

RESPONSE

Years of rigorous scientific training and immersion in one of the most professional, vibrant, and diverse academic environments in the world have equipped me with strong interpersonal skills and the confidence to undertake both independent work and collaborative projects. My ability to contribute effectively across different settings is demonstrated below:

- **Independent research in the field of quantum materials and thin-film physics:** Following my PhD, I established my own research direction within the broader research themes of the ARC Centre of Excellence in Future Low-Energy Electronic Technologies (FLEET). I independently proposed a new class of topological semimetals with unconventional surface spin textures in non-magnetic compounds, and later developed systematic computational frameworks to investigate the electronic structure of atomically thin films under the influence of disorder and electric fields. These research directions have formed the foundation of my publication record, patent application, and recent grant success.
- **Leading by example in a team environment:** Modern scientific research relies on effective teamwork across disciplines. Throughout my career, I have worked closely with researchers from materials science, physics, chemistry, and engineering, contributing my expertise while learning from others. I actively mentor students, openly share knowledge and computational tools, and believe in fostering an environment where every team member can contribute their strengths toward a common research goal.
- **Collaborating to deliver world-class materials education:** I have contributed to undergraduate and postgraduate education through teaching *Computational Materials Science* under the Monash–CSU "2+2" program and by delivering DFT training workshops for Master's and PhD students at Monash University. I work closely with colleagues to develop curriculum, coordinate teaching activities, and continuously improve course delivery, with the shared goal of providing students with a high-quality learning experience.
- **Working together to build strategic partnerships:** Beyond research and teaching, I actively contribute to building collaborations between academia and industry. As the liaison for the Monash–Jiangxi Copper partnership, I organized the Faculty-side technical exchange by identifying and approaching academic leaders across the Faculty of Engineering whose expertise aligned with the company's interests, including Materials Science and Engineering, Civil Engineering, and Chemical Engineering. I coordinated meetings between these researchers and the visiting delegation, while briefing both sides beforehand to ensure discussions remained focused on concrete research opportunities rather than general introductions. This groundwork supported the collaboration from the initial discussions through to a successful high-level delegation visit and the signing of a formal Memorandum of Understanding in August 2024. I have also participated in a long-term partnership with the Australian start-up TQ Transistors, where collaborative efforts have resulted in research translation, a patent application, and successful competitive funding. These experiences have strengthened my ability to work productively with external organizations while advancing the University's research, innovation, and engagement objectives.

3 *Demonstrated statistical analysis and manuscript preparation skills; including developing a solid track record of refereed research publications in the fields of thin film magnetic or quantum materials.*

RESPONSE

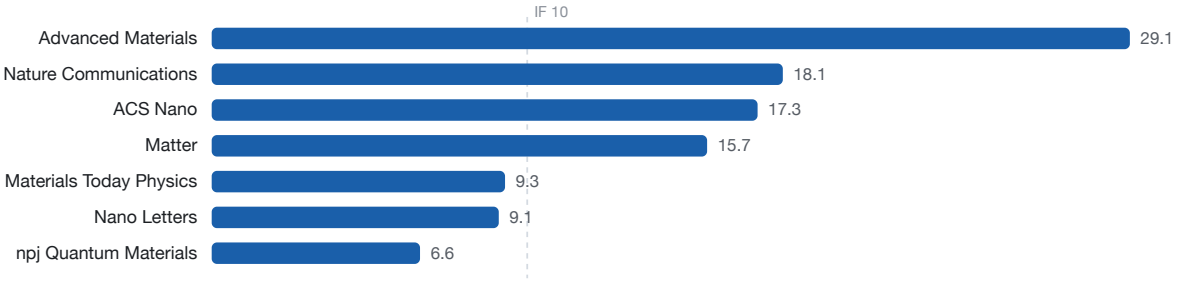
My publication record is concentrated precisely in the fields of thin-film and quantum materials, and reflects both strong statistical and computational analysis of complex materials datasets and extensive manuscript preparation experience through first, co-first, and corresponding authorship.

- **Thin-film magnetic materials:** This is the principal focus of my recent work, built around an integrated program on Heusler and Weyl ferromagnetic thin films that connects magneto-optical response, Berry-curvature transport, disorder tolerance, and magnonic behavior. I led the statistical and electronic-structure analysis behind *"Giant temperature-independent ultraviolet circular dichroism in Co_2MnX (X = Ga, Ge) Heusler magnetic thin films"* (*Physical Review Applied*, 2025), quantifying the magneto-optical response across the composition series and establishing its band-structure origin. In the co-first-authored *"Giant Berry curvature in the amorphous ferromagnet Co_2MnGa"* (*Matter*, 2025, IF 15.7), I contributed the theoretical framework explaining how a large Berry curvature survives the loss of long-range crystalline order — a result with direct implications for manufacturable, disorder-tolerant magnetic films. I then carried out the spin-wave band-structure analysis for *"Band-structure engineering to optimize spin-wave propagation in the Weyl ferromagnet $Co_2MnGa_{1-x}Ge_x$"* (*Advanced Materials*, 2025, IF 29.1), showing how composition tuning controls magnon dispersion for magnonic device applications. Complementing

these films, I provided the theoretical modeling for the room-temperature quantum metric effect in the kagome magnet $TbMn_6Sn_6$ (*Nature Communications*, 2025), and established a generic design route to intrinsic magnetic second-order topological insulators via inverted p–d orbitals (*Nano Letters*, 2024). Together these studies span the properties that matter most for thin-film magnetic technologies — magneto-optical response, anomalous transport, disorder robustness, and spin dynamics — and each required rigorous statistical analysis of large-scale computational datasets, careful validation against measurement, and close collaboration with experimental teams.

- **Quantum materials:** As first author, I established selective control of surface spin currents in the topological pyrite-type crystals OsX_2 (X = Se, Te) (*npj Quantum Materials*, 2019), laying the foundation for the surface-spin-texture engineering approach that has anchored my quantum materials research since. I also developed the tight-binding theory of two-dimensional bismuth allotropes (*New Journal of Physics*, 2021), then returned as corresponding author to uncover their unconventional spin texture (*Materials Today Physics*, 2023) and stabilize their topological edge states (*Materials Today Physics*, 2025) — a self-contained, half-decade example of leading thin-film theory from first principles through to device-relevant follow-up studies. More recently I co-first-authored *"Uncovering complex phonon interactions in $Mg_3Bi_{2-x}Sb_x$: topology and avoided crossings"* (*Nature Communications*, 2026), contributing the electronic-structure calculations that explained the observed phonon anomalies. These studies similarly relied on rigorous quantitative analysis, systematic interpretation of computational and experimental data, and effective scientific communication.
- **Statistical and computational analysis:** Across these projects my contribution is typically the quantitative core: designing the computational methodology, running and validating large-scale simulations on national facilities, and extracting statistically robust trends from high-dimensional datasets — composition series, disorder configurations, and band-structure ensembles — that can be tested directly against experimental measurement.
- **Manuscript preparation:** My publication portfolio spans the complete manuscript-development process, from conceiving research ideas and designing computational methodologies to data analysis, figure preparation, manuscript drafting, coordinating co-author revisions, and responding to peer-review comments. The bismuth-allotrope studies provide a representative example, spanning first-author foundational theory (2021) through to corresponding-author follow-up work (2025).
- **Track record:** These publications form part of a broader portfolio of more than 40 refereed papers (14 since 2024 alone, six published in journals with an impact factor above 10), attracting over 1,100 citations (h-index 19). This sustained publication record demonstrates my ability to consistently produce high-quality research in thin-film magnetic and quantum materials.
- **Peer review:** I also serve as a reviewer for leading journals including *Nature Communications* and *Communications Physics*. This experience keeps my own standards for statistical analysis, manuscript preparation, and scientific reporting aligned with best practice in the field.

SELECTED VENUES OF MY REFEREED PUBLICATIONS — JOURNAL IMPACT FACTOR



43	14	6	1,180	19
ORIGINAL RESEARCH ARTICLES	SINCE 2024	IN IF > 10 JOURNALS SINCE 2024	CITATIONS	H-INDEX

4 *Ability to work positively and cooperatively with students, internal and external teams and external organizations.*

RESPONSE

I have built this ability through concurrent responsibilities across mentoring, cross-Faculty research, and industry engagement.

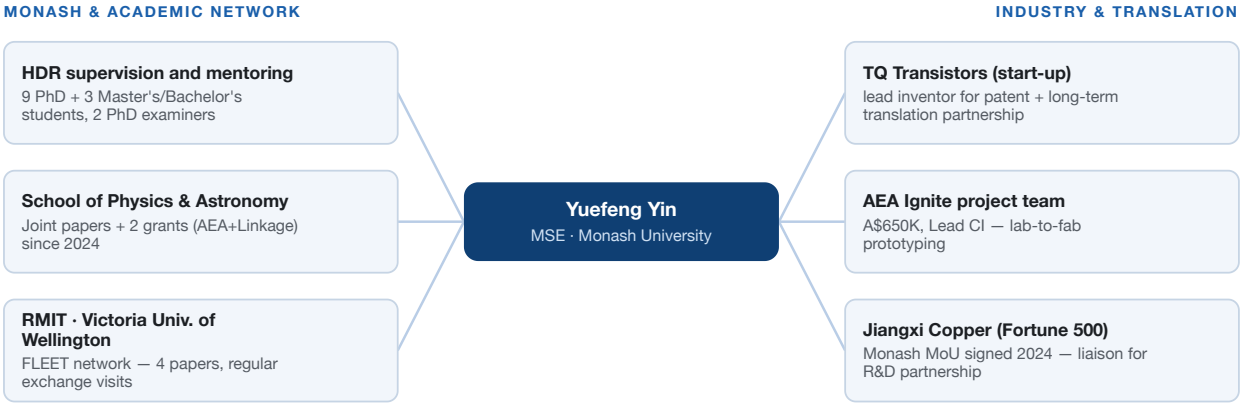
- **Students:** I have mentored or co-supervised nine PhD candidates (four current and five graduated) and three Bachelor's/Master's students, and examined two further PhD candidates in the Department. I believe in creating a supportive and collaborative research environment where students are encouraged to develop independence while

receiving appropriate guidance. This approach has contributed to mentees publishing first-author papers in *Advanced Science*, *ACS Nano*, and *Nano Letters*, while one graduated student now holds a joint postdoctoral position at the University of Cambridge and King's College London.

- **Internal teams:** My closest research partnerships sit outside my home Department, particularly in the School of Physics and Astronomy, where we have produced four co-authored papers since my FLEET years. Through my FLEET connections, I also maintain active collaborations with researchers at RMIT and the Victoria University of Wellington in New Zealand. I value long-term professional relationships and actively sustain these collaborations through regular visits and by proposing new collaborative research projects and funding applications.
- **External organizations:** I am the lead inventor on a U.S. patent application (US63/848,509) filed with the Australian start-up TQ Transistors, and I led Australia's Economic Accelerator (AEA) Ignite grant, which brings together an interdisciplinary experimental team around that technology. I also helped establish the Monash–Jiangxi Copper partnership, taking it from the first point of contact through to the signing of a formal Memorandum of Understanding, and I am now working toward establishing the first collaborative research project under this partnership.

In each of these relationships, my approach is the same: establish a shared understanding of what success looks like from the outset, maintain regular and open communication rather than only engaging when issues arise, and recognize the contributions of others generously. I believe this collaborative approach is one of the reasons many of my partnerships, including those with the School of Physics and Astronomy, RMIT, and the Victoria University of Wellington, have continued across multiple projects and many years.

WORK RELATIONSHIPS SPANNING ACADEMIA AND INDUSTRY



5 *Demonstrated strong record of teaching experience in a tertiary environment.*

RESPONSE

I have extensive teaching experience in tertiary settings at both undergraduate and postgraduate levels:

- **Lecturer, Computational Materials Science**, Central South University (2017–2019, 2023–2024), delivered on behalf of Monash University under the Monash–CSU "2+2" exchange program: an undergraduate elective covering condensed matter physics fundamentals, density functional theory, high-performance computing, and applied computational materials science projects. I was responsible for developing the course structure, teaching materials, lectures, tutorials, and assessments.
- **Postgraduate training**, I regularly deliver DFT training workshops and tutorials for Master's and PhD students, helping them understand fundamental concepts and select appropriate computational approaches for their own research problems.

This experience has provided me with a strong foundation in undergraduate and postgraduate teaching, encompassing curriculum development, lecture delivery, assessment design, and research skills training within a tertiary environment.

6 *Demonstrated ability to motivate, actively engage and educate a given audience.*

RESPONSE

I design my teaching and outreach around making abstract STEM concepts visible and interactive while retaining scientific rigor. I tailor the learning and communication experience for different audiences, ranging from academics

and students to industry partners and the general public, as demonstrated below:

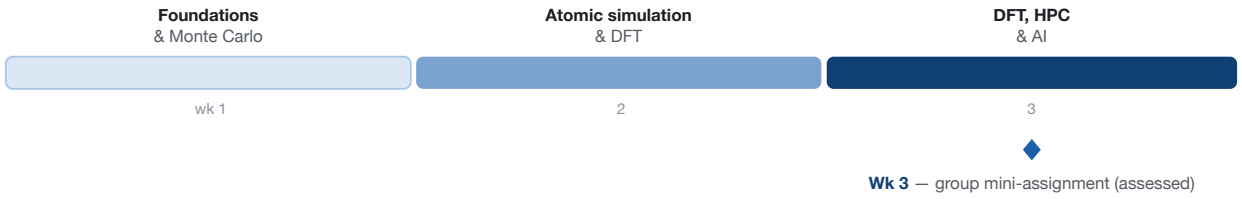
- In my regular interactions with our industry partner, TQ Transistors, I have expanded the use of interactive data visualizations and schematics to make our materials research more accessible to industrial collaborators and easier for intellectual property attorneys to understand.
- During my time with FLEET, I worked closely with FLEET's professional staff to produce public-facing outreach materials on quantum science. This included public engagement activities at Melbourne Knowledge Week, content shared through FLEET's X and YouTube channels, and contributions to Wikipedia to communicate advances in thin-film physics to a global audience.
- I maintain an active science communication presence on X and GitHub, where I share research updates and make my code and data openly available to support open science and broader community engagement.

7 *Demonstrated experience in curriculum and subject material development.*

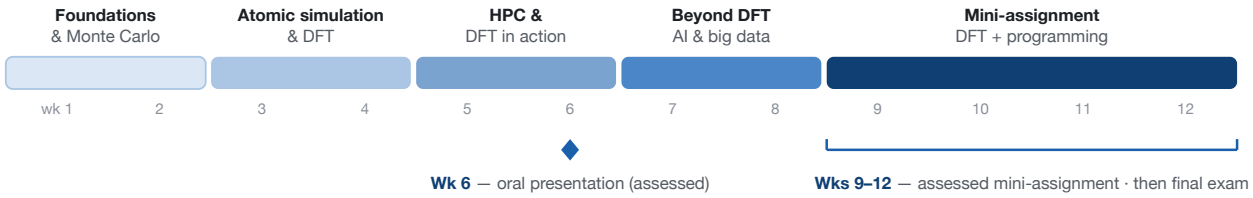
RESPONSE

My experience in curriculum design and subject development comes from my previous teaching of the Computational Materials Science course at Central South University as part of the Monash–CSU "2+2" program. The course was offered as an elective to third- and fourth-year undergraduate students, and I was responsible for developing the course structure and teaching materials for an intensive three-week program. The structure I designed is shown below. The course content was organized to build from fundamental concepts through density functional theory (DFT) and high-performance computing, finished in a group mini-assignment. This structure can also be expanded into a full 12-week course to provide a more immersive learning experience covering the core concepts and practices of computational materials science. The course materials are available on GitHub (https://github.com/yyfforce/CMS_Lec_Notes_CSU_Monash).

"COMPUTATIONAL MATERIALS SCIENCE" — THE INTENSIVE 3-WEEK STRUCTURE I DESIGNED



EXPANDED INTO A FULL 12-WEEK COURSE



Now, as the age of AI begins, my course design philosophy will adapt and evolve alongside these new technologies. I believe we should embrace the opportunities offered by AI and reshape how we teach the next generation of students. My first step would be to fully integrate AI-assisted learning and note-taking tools, such as Google NotebookLM, into course delivery. At the same time, I would place greater emphasis on teaching fundamental principles and the derivation process rather than technical details alone, as I believe an innovative and critical human mind is something we should really cherish in the age of AI.

8 *Proven ability, commitment and passion for engaging in scholarly and research activities.*

RESPONSE

I am committed to organizing and participating in a broad range of scholarly and research activities. I believe these activities are essential for advancing the field, building collaborations, and translating research into broader academic and societal impact. My contributions include:

- **Academic conferences and workshops:** Regularly attending domestic and international conferences, including presenting my research at the American Physical Society (APS) March Meeting and the International Conference

on Two-Dimensional Materials (ICON-2DMAT).

- **Academic visits:** Undertaking collaborative visits across Australia, including to ANU, RMIT, UNSW, and UQ, to strengthen research partnerships. I have also visited New Zealand's MacDiarmid Institute to expand collaborations and promote trans-Tasman research in quantum technologies.
- **Grant applications:** Securing funding through the AEA Ignite program and participating in a successful ARC Linkage Projects application. The total value of grants that I have led, co-led, or participated in now exceeds A$3.4 million. I have also secured substantial computational resources through national and internal competitive schemes, currently totaling approximately 2 million service units (SU) per year.
- **Patents:** Currently preparing a U.S. patent application on an innovative thin-film materials design for next-generation transistor technology.
- **Research translation:** Passionately pursuing opportunities to translate my research discoveries into real-world technologies through a long-term partnership with the Australian start-up TQ Transistors. I also work as a consultant with the Monash Center for Additive Manufacturing (MCAM), helping bring advanced manufacturing expertise to new industry partners.
- **Service to the research community:** Serving as a peer reviewer for leading journals in the field, including Nature Communications and Communications Physics, and acting as an examiner for three PhD candidates within the Department.

RESEARCH FUNDING SECURED SINCE 2024 — LED, CO-LED AND PARTICIPATED

A$0.65M — AEA Ignite (Lead CI) **A$1.04M** — industry R&D (Co-CI) **A$1.7M** — ARC Linkage (Key Participant)

9 *A demonstrated capacity to work in a collegiate manner with other staff in the workplace.*

RESPONSE

Working collegiately is embedded in how I conduct my everyday research and work. I believe in the value of mutual respect and open communication in fostering a healthy and productive workplace culture. Throughout my career, I have been privileged to learn from many outstanding academic and professional staff, and these experiences have shaped my own approach to collegiality. I am confident that I can continue to demonstrate the same collegiate manner if I am successful in this application.

In the following, I would like to share several examples from my past experience that demonstrate my commitment to working collaboratively and contributing positively to the workplace.

- Project meetings are an important part of managing the progress of ongoing research grants. I have frequently participated in such meetings with research teams from both my Department and other Faculties, including the groups of Prof. Julie Karel and Prof. Michael Fuhrer in the School of Physics and Astronomy. In these meetings, I maintain a professional and respectful approach when interacting with colleagues, always adopting the attitude of first understanding others' perspectives before making a considered assessment of my own views. I believe this approach fosters open communication, mutual respect, and productive discussions, allowing project meetings to proceed in an efficient and collaborative manner.
- Interacting with professional staff and technicians is critical to maintaining a safe, clean, and well-organized workplace. It is equally important to work closely with them in managing administrative tasks efficiently. A recent example was the organization of my office workspace following a request from Sonia, the Department's Operations Coordinator. She asked me to reorganize my desk to meet the Department's standards and occupational health and safety (OHS) requirements. I responded promptly to her request and sought clarification on the specific actions required. As a result, my workspace was reorganized into a clean and compliant environment that contributes to a safer and more welcoming workplace.
- Besides research, I have also offered my help during many Department events, including the annual Open Day, by working professionally and cooperatively with the Department's administrative team and academic staff.