Project Proposal Cover Sheet

Electronically fill out this proposal form and upload at www.paradim.org together with requested materials, *i.e.*, description and biosketch of PI. With questions or concerns please email: contact@paradim.org.

PARADIM USE ONLY

Project ID: _____

If US academic institution, Carnegie ranking

☐ R1 ☐ non-R1 ☐ Other

Project Classification

☐ PARADIM In-House Research Team

☐ Other JHU or Cornell University

☐ External

Submission Date

December 31, 2022

Project Title

Single crystals of TiO2 as a novel substrate for superconducting qubits

Type of Proposal *(check one option, for complete overview see http://www.paradim.org/user_program/project-proposals)*

☐ **Full Access** to (multiple) facilities, provide 2-page proposal **and** 2-page biosketch of PI

☑ **Materials Only** (standard samples from established PARADIM Synthesis recipes), enter paragraph of sample purpose during upload

☐ **Feasibility** (single PARADIM facility, maximum single day, *e.g.* feasibility tests), enter paragraph of project idea during upload

☐ **Kavli-PARADIM Summer Fellowship**, provide short paragraph of project idea **and** 2-page biosketch of PI

Facilities *(check all that apply)*

☐ PARADIM Computation/Theory @ Cornell (remote)

☐ PARADIM Thin Film Growth Facilities @ Cornell

☐ PARADIM Electron Microscope Facilities @ Cornell

☑ PARADIM Bulk Crystal Growth Facilities @ JHU

☐ Related facilities in Cornell Center for Materials Research (CCMR) @ Cornell

☐ Related facilities in Cornell NanoScale Science and Technology Facility (CNF) @ Cornell

☐ Related facilities in Cornell High-Energy Synchrotron Source (CHESS) @ Cornell

☐ Related facilities in Johns Hopkins Materials Characterization Facility @ JHU

Principal Investigator *(Principal Investigator should be the responsible Faculty member for an academic project)*

I Am	Sam	Postdoc
First Name	*Last Name*	*Title*
A University	A Department	
Institution	*Department*	
1 Quantum Way		
Street		
Washington	DC	00001
City	*State*	*Zip*
1-555-555-0100	iamsam@example.com	
Phone	*Email*	

Major Funding Agencies for your part of this work *(non-public, for NSF reporting only)*

☐ NSF DMR
☐ NSF CHE
☐ NSF CBET
☐ NSF CMMI
☐ NSF ECCS
☐ Other NSF MPS
☐ Other NSF ENG

☑ AFOSR
☐ ARO
☐ DARPA
☐ ONR
☐ Other DOD

☐ DOE
☐ NASA
☐ NIH
☐ NIST
☐ Other US Gov't

☐ US Foundation
☐ Industry
☐ International
☐ Other _____
☐ None

Institution Type *(based on the Principal Investigator's affiliation)*

☑ US Academic
☐ US (large) Industry
☐ US (State or Federal) Government

☐ US Small Company
☐ Non-profit Research Organization
☐ Foreign Academic

☐ Foreign Government/Industry
☐ Other

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☐ If accepted, I would like the opportunity to brainstorm ideas related to my proposal with PARADIM Faculty(default=no)

☐ Please do not disclose by proposal or its contents to the following PARADIM faculty _____
(default, will be shared as necessary only to evaluate safety, feasibility, and allocation)

Previous PARADIM proposals by PI

__ Yes ✔ No

If yes, ID number(s) _____

Collaborators *(anybody who will grow, characterize, or use samples, PARADIM staff scientists or external, i.e. potential co-authors; Collaborators will not be contacted directly; list can be amended after approval)*

Name	Institution	Status	Role	Email	Summer School
Collaborator 1	Place 2	Faculty			None
		Faculty			None
		Faculty			None
		Faculty			None
		Faculty			None
		Faculty			None
		Faculty			None
		Faculty			None

Expected Laboratory Users *(for **Full-Access proposal only**, remote or in-person, additional users can also be added later)*

Name	Institution	Status	Email	Summer School
		Faculty		None
		Faculty		None
		Faculty		None
		Faculty		None
		Faculty		None
		Faculty		None
		Faculty		None

Short paragraph describing the project idea and required access, to be entered on the submission page

Recent advances in choice of superconducting material have improved superconducting qubit coherence times to the millisecond level. Recent work by our team (unpublished) has shown that the main limiter of coherence times is now not the quality of the superconducting metal film, but rather losses at the interface between the metal and the sapphire substrate. TiO_2 has recently been predicted to have a smaller microwave loss tangent than Al_2O_3 at the operational frequency of our qubits. We thus request a 20 mm long by 6 mm OD boule of TiO_2, oriented along (001), to be used to prepare novel substrates to test this hypothesis. PARADIM staff noted this material has previously been grown in the facility, and should require minimal effort to provide a specimen for our use. This project fits into PARADIMs theme of novel electronic and interfacial materials by exploring the interfacial structures responsible for decoherence in superconducting qubits, and is an example of materials by design, combining our theoretical prediction with experimental synthesis and characterization to improve the theoretical models.