Dear Ilakkuvaselvi,

Here is the copy of the Project Pitch with reference number : **00077437** submitted to the **Quantum Information Technologies (QT)** on **2/27/2024**.

1. Submitter Name

   `Ilakkuvaselvi Manoharan`

2. Submitter Email

   `ilakk2023@gmail.com`

3. Submitter Phone

   `3093637732`

4. Company Name

   `Bubbles & Cafe Inc.`

5. State

   `IL`

6. Zip Code

   `60504`

7. Corporate Website

   `N/A`

8. SBIR/STTR topic that best fits your projects technology area

   `Quantum Information Technologies (QT)`

9. Is this Project Pitch for a technology or project concept that was previously submitted as a full proposal by your company to the NSF SBIR/STTR Phase I Program – and was not awarded ?

   `No`

10. Has your company received a prior NSF SBIR or STTR award?

    `No`

11. Does your company currently have a full Phase I SBIR or STTR proposal under review at NSF?

    `No`

12. Briefly Describe the Technology Innovation?

1. The Technology Innovation:

The technical innovation that would be the focus of a Phase I project:

The Phase I project focuses on the development and implementation of Physics Informed Neural Networks (PINNs) for optimizing Quantum Material Synthesis and Fabrication Processes, **both on Earth and in Microgravity environments.** This innovative approach aims to revolutionize the optimization of quantum material synthesis by integrating physics-based modeling with neural network techniques. The key components of this technical innovation include:

1. **PINN Development:** The technical innovation at the core of the Phase I project involves leveraging Physics Informed Neural Networks (PINNs) for the optimization of quantum material synthesis and fabrication processes. PINNs combine the power of neural networks with the principles of physics to model and optimize complex systems governed by physical laws. In the context of quantum material synthesis, PINNs offer a novel approach to address challenges related to optimization, efficiency, and precision in the fabrication processes.

The key components of this innovative approach include:

- **Modeling Quantum Material Synthesis: Develop PINNs capable of accurately modeling the synthesis process of quantum materials. These neural networks will be trained using available experimental data and theoretical knowledge of the underlying physical processes involved in the synthesis.**
- **Incorporating Physical Principles: Integrate the fundamental principles of quantum mechanics and material science into the PINN architecture. This involves encoding knowledge about the thermodynamics, kinetics, and structural properties of quantum materials directly into the neural network model.**
- **Optimization of Synthesis Parameters: Utilize PINNs to optimize synthesis parameters such as temperature, pressure, precursor concentrations, and reaction times. The PINN model will iteratively adjust these parameters to maximize desired material properties while satisfying physical constraints and optimizing the fabrication process.**
- **Prediction of Material Properties: Leverage the trained PINN model to predict the properties of synthesized quantum materials under different synthesis conditions. This includes predicting crystal structure, morphology, defects, electronic properties, and other relevant material characteristics.**
- **Feedback Loop for Experiment Design: Establish a feedback loop between**

the PINN model predictions and experimental synthesis efforts. The model's predictions will guide the design of experiments by suggesting optimal synthesis conditions, thereby accelerating the discovery and development of new quantum materials with tailored properties.

- **Scalability and Generalization: Ensure that the developed PINN model is scalable and capable of generalizing across different quantum material systems and synthesis techniques. This will enable its application to a wide range of materials and experimental setups, facilitating broader impact and applicability.**

1. **Computational Modeling and Simulation Tools:** Computational models and simulation tools will be developed to provide insights into the synthesis and fabrication processes of quantum materials. These tools will generate valuable data for training the PINNs, allowing the neural networks to learn the relationships between synthesis parameters and material properties.
2. **Quantum Simulations:** Quantum simulations will be utilized to predict thermodynamic stability, crystal structure, and growth kinetics of materials under different synthesis conditions. The insights gained from these simulations will guide the development and training of the PINNs, enabling the neural networks to make accurate predictions about material properties based on synthesis parameters.
3. **Design Strategies for Material Control:** Strategies for controlling morphology, composition, and defect formation in quantum materials will be developed to enhance their performance and functionality. These strategies will inform the development of PINN models, ensuring that the neural networks can predict how changes in synthesis conditions impact material properties and guide optimization efforts.
4. **Specialized Reaction Vessel Development:** Specialized reaction vessels will be designed and optimized for Quantum Material Synthesis, both on Earth and in Microgravity. These vessels will serve as experimental platforms for testing and validating PINN predictions. Additionally, the reaction vessels will act as digital twins to the PINNs, providing real-time feedback on synthesis conditions and enabling the optimization of synthesis processes.

In summary, the Phase I project focuses on harnessing the power of Physics Informed Neural Networks for the optimization of quantum material synthesis and fabrication processes. By integrating physics-based modeling with machine learning techniques, quantum simulations, and experimental validation, this innovative approach has the potential to revolutionize the discovery, design, and manufacturing of advanced quantum materials with tailored properties for various technological applications.

The origins of the innovation in leveraging Physics Informed Neural Networks (PINNs) for optimizing quantum material synthesis and fabrication processes can be traced to the convergence of several key areas of research and technological advancements.

- **Neural Networks and Machine Learning: PINNs originate from artificial neural networks (ANNs) and machine learning, particularly deep learning, which have seen significant progress due to advances in computational power, algorithms, and data availability.**
- **Physics-Based Modeling: Physicists and engineers have long utilized physics-based models to understand complex systems, including those governed by quantum mechanics, providing insights into phenomena such as material synthesis and fabrication processes.**
- **Integration of Physics and Machine Learning: PINNs bridge physics-based modeling and machine learning by embedding physical principles directly into neural network architectures, enabling the incorporation of prior knowledge and ensuring physical consistency in predictions.**
- **Quantum Materials Research: Quantum materials, with unique properties arising from quantum mechanics, have emerged as promising candidates for various applications. However, their synthesis and optimization pose significant challenges due to complex requirements and sensitivity to conditions.**
- **Demand for Optimization and Accelerated Discovery: There is a growing demand for efficient optimization techniques in materials science to accelerate discovery and development. Traditional trial-and-error methods are time-consuming and inefficient. PINNs offer a promising avenue by combining machine learning's predictive power with physics-based insights to optimize synthesis processes and accelerate material discovery.**

The proposed innovation is unproven because it represents a novel approach that has not yet been fully validated or implemented in practice. While Physics Informed Neural Networks (PINNs) hold promise for optimizing quantum material synthesis and fabrication processes, their effectiveness in this specific application has not been conclusively demonstrated.

Several factors contribute to the unproven nature of this innovation:

- **Limited implementation: PINNs for quantum material synthesis are a new and untested approach.**
- **Complexity of quantum materials: Quantum materials present intricate behaviors governed by quantum mechanics, adding uncertainty to the**

effectiveness of PINNs.

- **Integration of multiple disciplines: The innovation combines physics-based modeling, machine learning, quantum simulations, and experimental validation, introducing complexities and uncertainties.**
- **Limited experimental validation: The approach lacks extensive experimental trials to validate its practical applicability and reliability.**
- **Potential limitations and challenges: Challenges such as computational complexity, data requirements, and generalization to different material systems and synthesis techniques need to be addressed.**

The proposed innovation is high-impact because it addresses several critical challenges in quantum material synthesis and fabrication processes while offering significant potential for advancement and practical application:

- **Enhanced optimization and efficiency in quantum material synthesis through Physics Informed Neural Networks (PINNs).**
- **Integration of physics-based modeling and machine learning for addressing complex synthesis challenges.**
- **Accurate prediction and control of material properties under varying synthesis conditions using PINN models.**
- **Establishment of a feedback loop between PINN predictions and experimental synthesis efforts for accelerated discovery.**
- **Scalability and generalization of PINN model for broad application across diverse quantum material systems and synthesis techniques.**

13. Briefly Describe the Technical Objectives and Challenges?

2. The Technical Objectives and Challenges:

The R&D work to be done in a Phase I project described above involves the following key tasks:

- **Development of Physics Informed Neural Networks (PINNs): This involves creating PINNs capable of accurately modeling the synthesis process of quantum materials. The neural networks will be trained using experimental data and theoretical knowledge to incorporate physical principles and optimize synthesis parameters.**
- **Incorporation of Physical Principles: Integrating the fundamental principles of quantum mechanics and material science into the PINN architecture, encoding knowledge about thermodynamics, kinetics, and structural properties directly into the neural network model.**
- **Optimization of Synthesis Parameters: Utilizing PINNs to optimize synthesis parameters such as temperature, pressure, precursor concentrations, and reaction times. The PINN model will iteratively adjust these parameters to maximize desired material properties while satisfying physical constraints and optimizing the fabrication process.**
- **Prediction of Material Properties: Leveraging the trained PINN model to predict the properties of synthesized quantum materials under different synthesis conditions, including crystal structure, morphology, defects, and electronic properties.**
- **Feedback Loop for Experiment Design: Establishing a feedback loop between PINN model predictions and experimental synthesis efforts. The model's predictions will guide the design of experiments by suggesting optimal synthesis conditions, accelerating the discovery and development of new quantum materials.**
- **Scalability and Generalization: Ensuring that the developed PINN model is scalable and capable of generalizing across different quantum material systems and synthesis techniques to facilitate broader impact and applicability.**
- **Development of Computational Modeling and Simulation Tools: Creating computational models and simulation tools to provide insights into the synthesis and fabrication processes of quantum materials, generating valuable data for training the PINNs.**
- **Utilization of Quantum Simulations: Using quantum simulations to predict thermodynamic stability, crystal structure, and growth kinetics of materials under different synthesis conditions, guiding the development and training of the PINNs.**
- **Design Strategies for Material Control: Developing strategies for controlling morphology, composition, and defect formation in quantum**

materials to enhance their performance and functionality, informing the development of PINN models.

- **Development of Specialized Reaction Vessels: Designing and optimizing specialized reaction vessels for Quantum Material Synthesis on Earth and in Microgravity, serving as experimental platforms for testing and validating PINN predictions and providing real-time feedback on synthesis conditions.**

Overall, the Phase I project involves comprehensive R&D efforts aimed at advancing the understanding and optimization of quantum material synthesis and fabrication processes through the innovative integration of physics-based modeling with machine learning techniques, quantum simulations, and experimental validation.

The proposed work will help prove the technical feasibility and significantly reduce technical risk of the product or service through the following means:

- **PINN Development: Leveraging Physics Informed Neural Networks (PINNs) for accurate modeling and optimization of quantum material synthesis.**
- **Incorporating Physical Principles: Integrating fundamental principles of quantum mechanics and material science into the PINN architecture.**
- **Optimization of Synthesis Parameters: Using PINNs to optimize synthesis parameters, enhancing control and efficiency in fabrication processes.**
- **Prediction of Material Properties: Employing trained PINN models to predict material properties under various synthesis conditions.**
- **Feedback Loop for Experiment Design: Establishing a feedback loop between PINN predictions and experimental efforts, accelerating material discovery.**
- **Scalability and Generalization: Ensuring the developed PINN model's scalability and generalization across different material systems and synthesis techniques.**
- **Computational Modeling and Simulation Tools: Developing computational models and simulation tools to provide insights into synthesis processes.**
- **Quantum Simulations: Utilizing quantum simulations to guide PINN development and provide accurate predictions of material behavior.**
- **Design Strategies for Material Control: Developing strategies to enhance material performance and functionality through controlled synthesis.**
- **Specialized Reaction Vessel Development: Designing and optimizing reaction vessels for experimental validation of PINN predictions.**

These components collectively prove technical feasibility and reduce technical risk by providing a systematic approach to optimizing quantum material synthesis processes.

This work is crucial for making the new product, service, or process commercially viable and impactful in several ways:

- **Enhanced Efficiency and Precision: By optimizing quantum material synthesis processes, the use of PINNs can lead to increased efficiency and precision in fabrication. This translates to reduced production costs and improved quality control, making the resulting products more commercially viable.**
- **Tailored Material Properties: The ability to predict material properties accurately under different synthesis conditions allows for the customization of materials to meet specific requirements. This tailoring of material properties can lead to the development of innovative products with enhanced functionalities, driving market competitiveness and commercial success.**
- **Accelerated Innovation Cycles: The establishment of a feedback loop between PINN predictions and experimental synthesis efforts accelerates the discovery and development of new quantum materials. This rapid iteration and optimization process can significantly shorten innovation cycles, allowing for quicker product development and time-to-market, which is crucial for commercial viability.**
- **Broader Applicability: Ensuring scalability and generalization of the developed PINN model enables its application to a wide range of materials and experimental setups. This broad applicability increases the potential market reach of the resulting products and processes, enhancing their overall commercial impact.**
- **Facilitated Technological Advancement: The integration of physics-based modeling with machine learning techniques, quantum simulations, and experimental validation represents a significant technological advancement. Such advancements not only enable the development of new products and processes but also contribute to the overall advancement of technology in the field, attracting investment and fostering growth opportunities.**

The proposed work meets the definition of Research and Development (R&D) due to several key factors:

- **Innovative Approach: The project introduces an innovative approach by leveraging Physics Informed Neural Networks (PINNs) for the optimization of quantum material synthesis. This represents a departure from conventional engineering methods, requiring exploration**

and experimentation to develop and refine the PINN models.

- **Fundamental Research: The development and implementation of PINNs involve fundamental research into the integration of physics-based modeling with machine learning techniques. This research aims to advance the understanding of how neural networks can effectively model complex systems governed by physical laws.**
- **Exploratory Nature: The project involves exploratory research to model and optimize quantum material synthesis processes. This includes developing novel strategies for incorporating physical principles into the PINN architecture and optimizing synthesis parameters based on predictions generated by the neural network model.**
- **Iterative Process: The project incorporates an iterative process of experimentation and validation, including the establishment of a feedback loop between PINN predictions and experimental synthesis efforts. This iterative approach is characteristic of R&D activities aimed at exploring and refining new methodologies.**
- **Quantum Simulations and Specialized Reaction Vessels: The utilization of quantum simulations and the development of specialized reaction vessels further underscore the research-oriented nature of the project. These components involve experimentation and exploration to improve the accuracy and effectiveness of the PINN models.**

Overall, the proposed work involves significant research efforts aimed at advancing knowledge and capabilities in the field of quantum material synthesis, making it well-aligned with the definition of Research and Development.

14. Briefly Describe the Market Opportunity?

3. The Market Opportunity:

- **Customer Profile:**
  - **Space Tech Companies, NASA, ISS: Entities involved in space exploration, satellite manufacturing, and space station operations, seeking advanced materials for spacecraft components, radiation shielding, and space-based experiments.**
  - **Quantum Computing Companies (e.g., Google, IBM): Companies at the forefront of quantum computing research and development, requiring high-quality quantum materials for qubits, quantum processors, and quantum computing hardware.**
  - **Quantum Computing Startups: Emerging companies specializing in quantum computing technologies, with a focus on developing scalable and reliable quantum computing platforms, applications, and services.**
  - **Quantum Materials Researchers and Manufacturers: Academic institutions, research laboratories, and companies engaged in nano materials research, nanotechnology, and nano electronics, quantum computing aiming to explore and exploit the unique properties of quantum materials for various applications.**
- **Pain Points:**
  - Existing synthesis and fabrication processes for quantum materials are often inefficient, costly, and labor-intensive.
  - Achieving precise control over material properties is challenging, leading to inconsistencies and limitations in material performance.
  - Lack of robust optimization tools and predictive models hinders the development of quantum materials with tailored properties.
- **Near-Term Commercial Focus:**
  - Consultancy Services: Offering expertise to optimize quantum material synthesis processes for various industries.
  - Software Tools: Developing specialized software for simulation and optimization of synthesis protocols.
  - Specialized Reaction Vessels: Designing vessels for optimized synthesis of quantum materials and nanomaterials on earth as well as in microgravity.
- **Partnerships:**
- NASA and ISS Collaboration: Conducting experiments on quantum material synthesis in microgravity.
- SpaceTech Companies Partnership: Integrating quantum materials into space technologies for enhanced performance.
- **Product Offerings:**
- Nano Materials: Portfolio includes nano materials for electronics, photonics, catalysis, and biomedical applications.
- Quantum Materials: Offering precise quantum materials tailored for quantum computing,

sensing, and space exploration.

15. Briefly Describe the Company and Team?

4. The Company and Team:

The team consists of only the solo founder - Ilakkuvaselvi Manoharan

Ilakkuvaselvi (Ilak) Manoharan is a highly skilled and experienced professional based in Aurora, IL. With a diverse background in entrepreneurship, product management, research, and engineering, Ilak brings a unique set of skills and expertise to various industries.

Ilak is currently the Founder, CEO, Scientist, Researcher, and Engineer at Bubbles & Café Inc, an organization focused on research exploration, innovation, and product development. In this role, Ilak actively engages in scientific research, drives product development initiatives, and oversees the overall operations of the organization. Additionally, Ilak is involved in startup development and fundraising activities, demonstrating a strong entrepreneurial spirit.

In the beginning of 2023, Ilak has applied for a utility patent for AIOS IoT Smart Restaurant. As a strategic thinker and experienced product manager, Ilak combines scientific knowledge with business acumen to drive the success of the venture.

Ilak's expertise extends to mobile app development, with a focus on iOS and Android platforms. With a portfolio of successful apps available on both the App Store and PlayStore, Ilak has demonstrated proficiency in Swift, Flutter, and other related technologies. Ilak's background also encompasses data engineering, data science, and backend development using technologies such as Java, Spring, Hibernate, RDBMS, NoSQL, and Python.

Throughout Ilak's career, leadership, creativity, adaptability, and problem-solving skills have been key attributes that have contributed to success in various roles. Ilak has experience working in renowned companies such as JPMorgan Chase, Accenture, McDonald's, and Caterpillar, where they have held positions ranging from lead application developer to solution architect.

Ilak holds a Master's degree in Electrical Engineering with a minor in Software Engineering from Texas A&M Kingsville, as well as a Bachelor's degree in Electronics and Instrumentation Engineering from the University of Madras. She have also acquired additional certifications in software development.

Overall, Ilakkuvaselvi (Ilak) Manoharan is a multifaceted professional with a passion for entrepreneurship, innovation, and leveraging technology to drive positive change. Through her diverse skill set and experiences, Ilak is poised to make significant contributions in various domains, particularly in research, product development, the advancement of the AIOS IoT Smart Restaurant concept and quantum computing.

From the beginning of 2023, Ilak have been applying for various federal grants, most of them focusing on material synthesis for qubits.

Here are her federal grants proposal submission history:

Name of Agencies: ISS National Lab
Date of Proposal Submission: April 5, 2023
Title, Number, and Date of Solicitations: NLRA 2023-6: In-space Production Applications: Advanced Materials and Manufacturing, Open period: 02/13/2023 – 07/20/2023
Specific Applicable Research Topics: In-Space Production Applications: Advanced Materials and Manufacturing
Titles of Research Projects: Exploring alternative materials and methods for synthesizing quantum dots that are less toxic and more sustainable.
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: ISS National Lab
Date of Proposal Submission: April 5, 2023
Title, Number, and Date of Solicitations: NLRA 2023-6: In-space Production Applications: Advanced Materials and Manufacturing, Open period: 02/13/2023 – 07/20/2023
Specific Applicable Research Topics: In-Space Production Applications: Advanced Materials and Manufacturing
Titles of Research Projects: Studying the fundamental physics of optical phenomena in microgravity environments, such as Bose-Einstein condensates, to better understand the behavior of matter and light in space.
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: ISS National Lab
Date of Proposal Submission: Aug 9, 2023
Title, Number, and Date of Solicitations: NLRA 2023-8: TECHNOLOGY

ADVANCEMENT AND APPLIED RESEARCH LEVERAGING THE ISS NATIONAL LAB, Open period: 5/15/2023 – 10/9/2023
Specific Applicable Research Topics: TECHNOLOGY ADVANCEMENT AND APPLIED RESEARCH LEVERAGING THE ISS NATIONAL LAB
Titles of Research Projects: Experiments with Silicon Quantum Dots and Silicon Quantum Dots Spin Qubits in the Microgravity Environment.
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: ISS National Lab
Date of Proposal Submission or Award: Aug 9, 2023
Title, Number, and Date of Solicitations: NLRA 2023-8: TECHNOLOGY ADVANCEMENT AND APPLIED RESEARCH LEVERAGING THE ISS NATIONAL LAB, Open period: 5/15/2023 – 10/9/2023
Specific Applicable Research Topics: TECHNOLOGY ADVANCEMENT AND APPLIED RESEARCH LEVERAGING THE ISS NATIONAL LAB
Titles of Research Projects: Assessing QD-Cell interactions for safer biomedical use in the microgravity environment.
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: ISS National Lab
Date of Proposal Submission or Award: Aug 9, 2023
Title, Number, and Date of Solicitations: NLRA 2023-8: TECHNOLOGY ADVANCEMENT AND APPLIED RESEARCH LEVERAGING THE ISS NATIONAL LAB, Open period: 5/15/2023 – 10/9/2023
Specific Applicable Research Topics: TECHNOLOGY ADVANCEMENT AND APPLIED RESEARCH LEVERAGING THE ISS NATIONAL LAB
Titles of Research Projects: Zero-G Lithium: Microgravity Magnesiothermic Reduction for Sustainable Manufacturing.
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: National Science Foundation
Date of Proposal Submission or Award: July 8, 2023
Title, Number, and Date of Solicitations: NSF SBIR/STTR Project Pitch, 00064247
Specific Applicable Research Topics: Advanced Materials (AM)
Titles of Research Projects: Research and development of novel materials and fabrication methods for spin qubits and quantum dots.
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: National Science Foundation
Date of Proposal Submission or Award: June 6, 2023 - July 5
Title, Number, and Date of Solicitations: NSF SBIR/STTR Project Pitch, 00062573
Specific Applicable Research Topics: Nanotechnology (N)
Titles of Research Projects: Develop quantum dots that are less toxic and more sustainable, and to explore their applications in quantum computing, sensing and detection, as well as laser technology.
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: National Science Foundation
Date of Proposal Submission or Award: May 29, 2023
Title, Number, and Date of Solicitations: NSF SBIR/STTR Project Pitch
Specific Applicable Research Topics: Internet of Things (I)
Titles of Research Projects: Cloud Native AIOS IoT Smart Restaurant with Smart Kitchen for Contactless Food Preparation, Ordering & Vending
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: NASA
Date of Proposal Submission or Award: Sep 21, 2023
Title, Number, and Date of Solicitations: NASA SBIR Ignite
Specific Applicable Research Topics: Closing Capability Gaps to Accelerate In-Space Production Applications in LEO.
Titles of Research Projects: Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanocrystal Growth in Microgravity
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: ISS National Lab
Date of Proposal Submission or Award: Sep 25, 2023
Title, Number, and Date of Solicitations: NLRA 2023 - 10 IGNITING INNOVATION: SCIENCE IN SPACE TO CURE DISEASE ON EARTH NLRA Open Period: 8/8/2023 – 3/8/2024
Specific Applicable Research Topics: Advanced technologies for biomanufacturing
Titles of Research Projects: Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanomaterial

Growth in Microgravity
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

Name of Agencies: NSF
Date of Proposal Submission or Award: Sep 26, 2023
Title, Number, and Date of Solicitations: NSF SBIR/STTR Project Pitch
Specific Applicable Research Topics: Advanced Manufacturing (M)
Titles of Research Projects: Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanomaterial Growth in Microgravity
Name and Title of Principal Investigator or Project Manager: Ilakkuvaselvi Manoharan, CEO, Bubbles & Café Inc.

16. How did you first hear about our program?

NSF email, webinar, or event

NSF SBIR/STTR Phase I Eligibility Information:

In addition to receiving an invitation to submit a full proposal from the NSF SBIR/STTR Phase I Program based upon the review of their submitted Project Pitch,potential proposers to the program must also qualify as a small business concern to participate in the program (see SBIR/STTR Eligibility Guidefor more information).

The firm must be in compliance with the SBIR/STTR Policy Directive(s) and the Code of Federal Regulations (13 CFR 121).

- Your company must be a small business (fewer than 500 employees) located in the United States. Please note that the size limit of 500 employees includes affiliates.
- At least 50% of your company's equity must be owned by U.S. citizens or permanent residents, and all funded work needs to take place in the United States (including work done by consultants and contractors).
- Primary employment is defined as at least 51 percent employed by the small business. NSF normally considers a full-time work week to be 40 hours and considers employment elsewhere of greater than 19.6 hours per week to be in conflict with this requirement.
- The Principal Investigator needs to commit to at least one month (173 hours) of effort to the funded project, per six months of project duration.

For more detailed information, please refer to the SBIR/STTR Eligibility Guide by using https://www.sbir.gov/sites/default/files/elig_size_compliance_guide.pdf. Please note that these requirements need to be satisfied at the time an SBIR/STTR award is made, and not necessarily when the proposal is submitted.