

STATEMENT OF CONSIDERATIONS

REQUEST BY INVENTOR KEVIN HUANG FOR THE WAIVER OF DOMESTIC AND FOREIGN RIGHTS TO THE IDENTIFIED INVENTION ENTITLED:

SPIN-TRIPLET SUPERCONDUCTORS AS A QUBIT MATERIAL FOR QUANTUM INFORMATION SYSTEMS

THE ABOVE-REFERENCED INVENTION BEING DEVELOPED UNDER DOE CONTRACT No.: DE-AC52-07NA27344, LAWRENCE LIVERMORE NATIONAL LABORATORY M&O CONTRACT, ASSIGNED DOE INVENTION DISCLOSURE No.: S-170,662, AND DOE WAIVER No.: W(I) 2021-002.

The Inventor and Petitioner of the subject matter technology, Kevin Huang (*hereinafter* the Petitioner) requests a waiver of the Government's domestic and foreign patent rights in the present invention, the invention is entitled: *Spin-Triplet Superconductors as a Qubit Material for Quantum Information Systems*.

BACKGROUND OF THE INVENTION

The subject invention has been conceived by the Petitioner during the Petitioner's tenure as a research employee of Lawrence Livermore National Security, LLC. Lawrence Livermore National Security, LLC is the Management and Operation Contractor for Lawrence Livermore National Laboratory (LLNL), a government owned contractor operated (GOCO) facility and subject to DOE contract number DE-AC52-07NA27344 at the time of the conception of the subject matter invention.

The invention was conceived by the Petitioner outside of their research duties at LLNL. However, the Petitioner spent approximately 10 hours of lab research time under a DOE funded project identifying potential LLNL research collaborators, while writing and submitting an invention disclosure and gathering data for an internal research proposal regarding the invention. The cost in support of these efforts is estimated to be approximately \$2,500.00.

The reported co-inventors for the subject invention are as follows: Gianpaolo P. Carosi, Yaniv Rosen, and Nathan Woollett. All co-inventors were employees of Lawrence Livermore National Security, LLC during the time that the subject invention was conceived. The co-inventors of the subject invention are not seeking a waiver for the identified invention.

While the invention was conceived during the scope of the funding agreement, the invention is not related to the work performed under the funding contract.

Presently, the Petitioner is prepared to promote the development and commercialization of the inventive subject matter if title to the inventive subject matter is granted to the Petitioner.

THE INVENTION

The present invention has been conceived but presently has not been reduced to any practicable form, and as such remains an inventive concept. Regarding the invention, it is accepted that quantum computers utilizing superconducting qubits suffer from low coherence times (i.e., how long the quantum information stays stable). Currently employed qubits are made of spin-singlet

superconductors, which show low coherence times and are sensitive to magnetism and magnetic impurities.

As such, the proposed spin-triplet superconductors (STS) of the present invention are a fundamentally new type of superconductor that show promise as a qubit material comprising intrinsic resistance to certain forms of decoherence, therefore allowing any qubits to maintain longer coherence times. The presently conceived invention proposes using intrinsically magnetic resistant spin-triplet superconductors (STS) as a new material for the construction of qubits that will be intrinsically resistant to magnetism, and therefore have better computational performance.

Lawrence Livermore National Laboratory has expressed, in writing, support for the Petitioner's request for title rights to the above-referenced invention.

DEVELOPMENTAL COMMERCIALIZATION PLAN

Quantum information systems are currently an attractive field for investments; however, most inventions are new computational system designs or algorithms. Petitioner's invention is materials-based, and as such differs from the traditional inventive designs of quantum information systems.

Petitioner's research and commercialization plan comprises a plan to further research efforts by approaching investment firms to gain funds so that they can enter a research partnership with LLNL or another federal laboratory to continue efforts to identify and characterize test samples for new qubit materials. Once viable material samples have been identified then efforts will pivot to focus on obtaining additional investment funds for the development of a qubit prototype. However, all research and investment plans are contingent upon Petitioner obtaining title to the subject invention and all data and information that was generated in support of the subject invention.

Approval of the waiver will allow Petitioner to publicize the invention and attract investments. There are several domestic companies actively working on quantum information systems. A domestic company that wishes to enter the quantum information system market has expressed interest in partnering with the Petitioner to further develop the invention. However, discussions cannot move forward with this company or other potential partners until title is granted to the Petitioner.

SUMMARY

A viable quantum computer promises to revolutionize the information industry, but current quantum computers have poor performance, partly because advancements have focused on circuit designs or algorithms and not material component builds. Proving the viability of the subject invention (a new quantum computing qubit material) will fill this material gap and present a great benefit to the domestic quantum computing field by being complimentary to current design/algorithm efforts of domestic quantum information companies.

LLNL has no plans to develop this invention further. Additionally, without title and the data and images generated in relation to the subject invention the Petitioner is unable to further develop the invention.

The granting of this waiver will increase competition in the market for qubit development. Currently there are three domestic companies that dominate the field. A new qubit invention will add more competition to the market in terms of qubit material providers. Further, the Petitioner would not be in a preferred or dominant market position since the present invention is material-based it would be a complementary component for utilization within the design and algorithm-based quantum information system approaches that are presently utilized within the industry.

Technology related to superconductor materials is listed as export controlled on the Commerce Control List (CCL) under export control classification number (ECCN) 1C005 and requires a license for export to certain regions. The technology of the present inventive subject matter is not applicable to the Naval Nuclear Propulsion Program, the nuclear weapons programs, or other nuclear or atomic energy defense activities of the DOE.

The Petitioner will abide by the export control laws and require its licensees (if any) to do the same.

As per this petition, the Petitioner agrees to abide by the provisions of 35 U.S.C. §§ 202 and 203. Further, the Petitioner agrees to abide by the preference for U.S. Industry standards as presented in 35 U.S.C. § 204, the requirements of which are set forth in the U.S. Competitiveness Clause.

As such, the Petitioner agrees to the following:

The Petitioner agrees that any products embodying any subject invention or produced using any subject invention will be manufactured substantially in the United States unless the Petitioner can show to the satisfaction of DOE that it is not commercially feasible.

In the event DOE agrees to foreign manufacture, there will be a requirement that the Government's support of the technology be recognized in some appropriate manner, e.g., alternative binding commitments to provide an overall net benefit to the U.S. economy.

The Petitioner agrees that it will not license, assign, or otherwise transfer any subject invention to any entity, at any tier, unless that entity agrees to these same requirements. Should the Petitioner or other such entity receiving rights in the invention(s): (1) undergo a change in ownership amounting to a controlling interest, or (2) sell, assign, or otherwise transfer title or exclusive rights in the invention(s), then the assignment, license, or other transfer of rights in the subject invention(s) is/are suspended until approved in writing by DOE.

The Petitioner and any successor assignee will convey to DOE, upon written request from DOE, title to any subject invention, upon a breach of this paragraph.

As mentioned above, there is no current interest in pursuing the commercialization of the subject matter technology on the part of Lawrence Livermore National Laboratory. As such, the granting of this waiver serves as the only way to promote the commercialization of the subject matter invention. Further, the Petitioner's desire to obtain title and actively seek the commercialization of the subject matter technology satisfies the objectives of the DOE/NNSA's technology transfer mission.

Thus, upon the evaluation of the present Petition for Waiver in view of the objectives and considerations as set forth in 10 CFR 784, it is recommended that the requested waiver be granted.

Wendell A. Peete
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Wendell A. Peete
Date: 2022.02.14
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Wendell A. Peete, Jr.
Patent Attorney
National Nuclear Security Administration

Based on the foregoing Statement of Considerations and the representations of the attached Waiver Petition, it is determined that the interests of the United States and the public will best be served by a waiver of patent rights of the scope described above and, therefore, the waiver is granted.

CONCURRENCE:

[Redacted signature]

Brian Kanagaki
Director
Office of Engineering & Technology Maturation
U.S. Department of Energy

Date: 14 February 2022

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Date: 2022.02.16 16:06:39
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APPROVAL:

Brian Lally
Assistant General Counsel
Technology Transfer and Intellectual Property
U.S. Department of Energy

Date: _____