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Future Markets for Quantum Information Science Technologies

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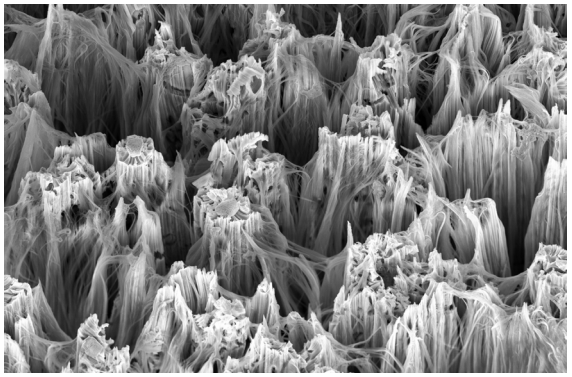
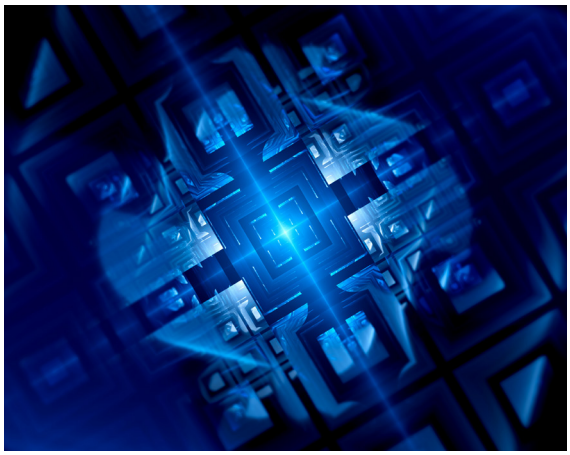
Quantum information science (QIS) builds on the study of the smallest particles of matter and energy to obtain and process information in ways that cannot be achieved using classical principles of physics. Will the technologies being developed using QIS translate into significant commercial markets in the future? To help answer this question, a team of IDA researchers assessed developments in three categories of quantum technologies: metrology and sensing, communications, and computing and simulation.



Quantum metrology and sensing is the category with the largest array of existing and potential commercial products. Further, some existing products, from atomic clocks, gravimeters, and gravitational gradiometers to atomic magnetometers, magnetoencephalography scanners, and electron microscopes, have been manufactured for decades. U.S. and European companies are the primary suppliers of quantum metrology and sensing technologies to the world market, which is well-established and small to medium in size.

Technologies in the quantum communications category are primarily used for securing communications. The potential advantages of quantum key distribution, quantum repeaters, and quantum random number generators for communications security are offset by their cost, complexity, and technical limitations. Large Japanese and Korean electronics and telecommunications companies have been investing in quantum communications technologies for the international market, while Chinese firms focused on quantum communications technologies have confined their activities to the Chinese domestic market.



Commercial products in the category of quantum computing and simulation are not likely to be widely available in the next 10 years, despite substantial government, academic, and commercial research activities. If proven to be technologically feasible, quantum computing and simulation products are likely to serve niche markets, like computing the ground-state energies of specific molecules. Small U.S. start-ups and small research teams within large U.S. technology firms dominate the global quantum computing industry, although European companies are also engaged in this sector.

The immediate commercial potential for QIS technologies appears to be modest. However, QIS has provided unique and powerful new technologies and will continue to do so. Over the course of the century, quantum technologies are likely to be economically important.

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