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Introduction to Quantum Computing **Project Task #02**
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These are three experimental demonstrations of quantum simulations. Noting its relative date of publication, describe your chosen paper's impact in the business trade press. Do you feel it had the largest influence of the three? Why or why not?

For the purposes of this paper, I've chosen to dig deeper into the paper Observation of a Many-Body Dynamical Phase Transition with a 53-Qubit Quantum Simulator, written by researchers at The University of Maryland, National Institute of Standards and Technology (NIST), as well as researchers at IonQ, one of the leading companies in developing quantum computers using trapped ion qubits. The paper documents the process of creating a 53 qubit quantum simulator, using atomic qubits, the states of which are manipulated using laser beams. Below is a list of the articles I found about the published paper:

1. From Science Daily, Quantum simulators wield control over more than 50 qubits, setting new record
2. From Vice, Physicists Made an Unprecedented 53 Qubit Quantum Simulator
3. From Phys.org, Quantum simulators wield control over more than 50 qubits, setting new record

While Science Daily and Phys.org are academia oriented publications, Vice intends to create content targeted more at young and young-adult readers, giving us an idea of the spectrum of interested audience in these technological developments. Essentially, all three articles have extremely similar, if not identical manners of reporting about the paper, mostly reporting quotes from the co-authors, and stressing the importance of these findings in developing a fully functional general purpose quantum computer, as per one of the co-authors, Alexey Gorshkov, NIST theoretical physicist, "After perfecting these quantum simulators, we can then implement quantum circuits and eventually quantum-connect many such ion chains together to build a full-scale quantum computer with a much wider domain of applications."

Based on these articles, the implications of such a paper is not only important for academia, but for industry as well, meaning that both are members of the "impacted audience." Of course, in quantum computing, as opposed to other disciplines, academia is not completely isolated from industry, since most of the time, if not exclusively, large corporations hire scientists from academia to be on their quantum research teams. For IonQ, the business implications of these findings can be huge, seeing as they are trying to build quantum computers using similar physical systems as were used in this simulator, and the success of this simulator directly impacts how they proceed as a business.

The other two papers used superconducting qubits in their simulations, and were a product of two of the leading corporations in the quantum computing world, one by IBM, the other one by Google. Business press for these two papers was more versatile in their opinions. Most press stressed the important implications for their findings, not only for the tech industry and academia, but also their

implications for the government, pharmaceutical industry, theoretical chemists, material scientists, and many more stakeholders, making for a wider impacted audience. The business opportunities, according to the articles about the other two papers, far surpass the business opportunities attributed to my chosen paper, at least based on the press I've been able to find. Opportunities include development of drugs, which, as far as business opportunities are concerned, is one of the most lucrative fields there is. A pharmaceutical quantum industry is expected to be as much as a 20 billion dollar industry by 2030.

Two of the papers employ superconducting qubits, and were from research at large corporations, while one paper describes research using atomic qubits, performed at a research university. Based on how these results were received in the news press, can you see how the technology, and the research institution, made a difference in expectations for future developments?

It is clear that papers developed by Google and IBM attracted more attention and had higher expectations attributed to their findings. The third paper also had a representative of the tech industry, IonQ, as one of their stakeholders, nevertheless its expectations, while high, could not compete with the type of expectations set forth by the achievements of the likes of Google and IBM. Quantum computing is a contentious field, and there has been an ongoing debate as to which modalities are best suited for implementing a fully functional general purpose quantum computer. Google and IBM swear by their reliance on superconducting qubits, while IonQ is making efforts in the direction of using trapped ions. This shows that, while the distinction between industry and academia is not that stark in the tech world, it nevertheless impacts the way their findings are received by the public, and the type of impact they have.

The papers put forth by Google and IBM created instant expectations of how their findings can help both the tech, and other industries capitalize on these technologies, and both are expected to produce multi-billion dollars worth of wealth for many corporations, including pharmaceuticals. I believe the reason for this disparity is that first, these tech giants simply have more money and resources that can be poured into making sure that the reactions to their publications are in line with what they intend, second, they are more trusted by the public, and their findings hold more credibility due to the long years of name recognition and success that they both enjoy.

Imagine that you are responsible for investing the money of a company or a funding agency interested in the further development of quantum computation. Would you invest your money in your chosen paper's project? Why or why not?

If I had the choice, I would prefer to invest my money in the projects of either Google or IBM, but not my chosen paper's project, for a few reasons:

1. The other two are more financially promising. While academia itself is important in developing technologies, their results lag behind those of the industry by decades maybe, simply because they do not have enough resources to realize them. They are simply not promising financially, they put forth ideas that could potentially be implemented in the future, but knowing the trajectory of these tech giants, I would much rather use my money to their advantage, because of the high reward that they guarantee.

2. In my opinion, as also stated in Task 4, superconducting qubits, I believe, will be the first to enter the market in the form of commercially available quantum computers, and hence my choice of investment is also rooted in that reasoning.

3. Lastly, I find academia to be more skeptical than industry, because the way papers are published is not as fair as it seems, and academics are in a rush to get published, even if it means compromising project integrity, so I don't think making investments in projects which are not entirely credible is an attractive idea. This also is a factor in repelling me from investing in the UMD + NIST project.