Quantum sensors open up new possibilities in many areas

Increased cooperation between Norwegian industry and universities within quantum physical sensors is a win-win situation for society. Such sensors can provide new opportunities in, for example, mineral extraction and agriculture.

The potential of quantum computers has been talked about a lot. Fewer people know that there are much more well-developed practical applications of quantum physics that are directly relevant to Norwegian companies and industry.

Quantum physical effects can be used to create ultra-sensitive sensors of, among other things, magnetic fields [1], as well as changes in the Earth's shape, movement, and gravitational field [2]. Precision measurements of such sizes have clear applications in Norwegian industry, for example in mapping the terrain and seabed for the extraction of minerals and other resources.

An increased focus on collaboration between Norwegian industry and universities within quantum physical sensors is therefore an obvious win-win situation for society.

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Selv om kvantedatamaskiner har potensial til radikale fremskritt innen informasjonsteknologi i fremtiden, er tiden mer moden for å benytte seg av det kvantefysikken har å tilby innen høypresisjonsmålinger.

Very sensitive measuring devices

Studies on quantum sensors is a field that aims to develop highly sensitive measuring devices by using basic principles from quantum mechanics.

Traditional sensors are limited by the sensitivity of the detection methods, but these new techniques can potentially far surpass these limitations.

These measuring devices make full use of the wave nature of matter to measure physical quantities such as magnetic and electric fields, temperature, pressure and even gravitational waves.

One example of such a sensor is the atomic clock, which uses the vibrational frequency of atoms to measure time with extreme precision. Other examples of quantum sensors include magnetometers that can detect small magnetic fields.

Quantum sensors have many fields of application

Quantum sensors can revolutionize areas such as navigation and medical imaging.

The same can be said for something as down-to-earth as mineral exploration and agriculture. In mineral exploration, quantum sensors can detect minerals that are difficult to find using traditional prospecting methods.

They will enable investigations of mineral deposits at completely different depths than what is available today.

These are absolutely central issues that the world community is forced to take a stand on.

They will be able to provide farmers with detailed information on soil fertility, crop health and water use. This information can be used to optimize crops and reduce waste.

By providing detailed information on soil and mineral properties, this type of new sensor can help reduce the environmental impact of these industries, make them more sustainable and contribute to a green shift.

Quantum sensors central to the world community

These are absolutely central issues that the world community is forced to take a stand on, in order to be able to feed an ever-growing population in a sustainable way.

It is clear that basic research in this field will be absolutely necessary. Quantum sensors are just one example, out of many, where basic research in the natural sciences will be absolutely necessary in order to create decisive technological breakthroughs.

Norway has world-class experts

Norway, one of the world's richest nations per capita, has researchers who claim to be at the top of the world in the relevant research fields, and must contribute to this.

In Norway, heavy industry players such as Equinor and Yara have the financial muscle needed to be able to support the free basic research that is necessary. In addition, the Research Council of Norway must obtain the necessary funds to be able to finance free basic research to a sufficient extent.

Must invest in basic research

Basic research in physics is central to the discovery of new technology.

History from the 19th and 20th centuries tells us that basic research in physics is central to the discovery of new technology.

Experiments with electromagnetic waves at the end of the 19th century laid the foundations for communicating over long distances with radio waves.

Ideas emerging in the early 20th century about stimulated emission in atoms led to laser technology.

Experimental measurements of electrical resistance in magnets in the late 1980s, without any intention of practical application, ten years later revolutionized magnetic storage technology. This is the basis of the huge storage clouds of Google, Apple, Microsoft and Facebook.

Early basic research into sending electromagnetic signals through ultra-clean fiber optic cables laid the foundation for the world's most important infrastructure, the internet.

The list of examples could be made much longer. Much central technology in today's society thus originates with pure basic research carried out many decades ago.

[1] R. Kleiner, D. Koelle, F. Ludwig and J. Clarke, Superconducting quantum interference devices: State of the art and applications, in Proceedings of the IEEE, vol. 92, no. 10, pp. 1534-1548, Oct. 2004, doi: 10.1109/JPROC.2004.833655.

[2] Stray, B., Lamb, A., Kaushik, A. et al. Quantum sensing for gravity cartography. Nature 602, 590–594 (2022). https://doi.org/10.1038/s41586-021-04315-3