Career development

How to get ahead in quantum tech

The quantum industry is blossoming and has lots of new and exciting jobs that physicists are well placed to fill. Laura Hiscott talks to experts who have studied the quantum-tech jobs market about what’s on offer and what skills you’ll need to forge a successful career in this area.

Whether it’s lasers, nuclear power, computing or IT, one of the most exciting aspects of living through the dawn of rapidly evolving technology is that it creates a lot of jobs. In fact, new industries often open up completely new roles that didn’t exist before, offering fresh career opportunities for those willing to take the plunge. Right now, there’s no better example of a burgeoning area than quantum technology and, fortunately for physicists, this an area they are a perfect fit for.

But what’s so new about quantum technology, given that everything from lasers and semiconductors to magnetic-resonance imagers and fibre-optic cables use quantum principles? These are often loosely characterized as “quantum 1.0” technologies, which rely on quantum effects like spin, tunnelling and quantized energy. The newer “quantum 2.0” technologies, in contrast, actually produce, exploit and read out quantum states of matter. To do this, they use more complicated quantum phenomena, such as superposition and entanglement.

This second wave of quantum tech is of particular interest to KTN, a UK-based organization that aims to drive innovation by promoting networks between universities, hi-tech firms, funding bodies and government organizations. In fact, Najwa Sidqi, a physicist who is KTN’s knowledge transfer manager for quantum technologies, believes that quantum devices could significantly outperform their predecessors.

“Quantum computers, for example, have the potential to handle much more data and to do calculations much more quickly and efficiently,” she says. “A lot of our physical and chemical problems can only be simulated and addressed using quantum models, because nature is quantum. It’s also been proven that photons are the only way to communicate data in a safe and unbreakable way, using the properties of superposition and entanglement.”

Riding the new quantum wave

Quantum 2.0 has three main areas: computing, sensing and communications. Quantum sensing encompasses technologies that use quantum effects to take extremely high-precision measurements, such as atomic clocks for measuring time and trapped ions for detecting electric fields. Quantum communications mostly involves building perfectly secure systems of transmitting information. But it is quantum computing that gets the most attention in the media.

“The main goal of this quantum revolution, which might or might not happen, is a digital quantum computer,” says Ciaran Hughes, a senior research fellow at CERN who recently co-wrote a paper entitled “Assessing the needs of the quantum industry” (arXiv:2109.03601). The paper reports on a survey of 57 US-based quantum companies who were asked about the jobs they would be hiring for in the next few years, as well as the skills and degrees they need employees to have. It is one of the first studies to look in depth at what kind of workforce the quantum industry will require.

Quantum computing is the most ambitious quantum 2.0 area, according to Heather Lewandowski, professor of physics at the University of Colorado Boulder, who co-wrote the report, with potential applications in everything from cryptography and drug design to new materials for carbon capture. In the near term, though, she thinks that quantum sensing is the area with the most immediate promise. Quantum gravity sensors, for example, which measure gravitational gradients very precisely, could be useful for civil engineering projects, and are closer to being ready for use than quantum computers.

Nevertheless, investment is very high across all these areas. That becomes obvious if you look at the interactive tool of the “quantum landscape”, drawn up by Sidqi and her colleagues at KTN, which maps out the UK’s activities in quantum tech. It includes information on publicly funded projects, as well as the six big national centres that house most of the UK’s research capabilities in the area.

The tool also lists 160 research groups and more than 200 businesses that have quantum capabilities, indicating the main