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Editorial

Applications of Cold-Atom-Based Quantum Technology

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Cold-atom systems are rapidly advancing in technical maturity and have, in many cases, surpassed their classical counterparts, becoming a versatile tool that is used in a variety of fundamental research applications. They have become an attractive platform from which to realise a range of quantum technologies due to the high level of control and accuracy they provide, with experimental prototypes now leaving the lab for use in practical applications.

The potential applications for cold-atom-based quantum technologies are extremely varied. Quantum clocks [1], for example, have applications in global positioning systems, radioastronomy and high-speed trading. Meanwhile, quantum sensors such as inertial sensors [2,3] or magnetometers [4] have applications in navigation, civil engineering and geophysics. Additionally, quantum computing [5] has a wide range of applications in many areas, including weather forecasting, cybersecurity and logistics optimisation.

While the first commercial products are currently emerging in the field of atomic clocks and gravity sensors, there is still a long way to go before the full potential of quantum sensors can be realised, and the use of full array of competitive commercial products becomes widespread. There are many challenges to be overcome, and these currently form active research areas across the quantum technology community. They include size, weight and power reductions, improved robustness, reduced measurement speed, improved stability and increased sensitivity.

This Special Issue will showcase the breadth and impact of the research that is currently being undertaken in the field of atom-based quantum technologies and their applications. In this Special Issue, we solicit review articles, original research papers, perspectives, and short communications covering all aspects of atom-based quantum sensors. This includes advances in component level technology, modelling, quantum enhancements, recent advancements, technology roadmaps, and demonstrations of cold-atom systems in different applications or environments. Due to the wide array of atom-based quantum technologies and applications, we are confident that this Issue will find a broad readership and attract much interest within the scientific community.

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