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# Ultracold quantum technologies

The creation of a Bose–Einstein condensate was a major milestone in the field of ultracold gases. Over seventy years passed from the first ideas predicting this phase of matter, which is characterized by a macroscopic occupation of a single quantum state, to its eventual experimental observation in 1995. But this was more than the confirmation of a long-standing theoretical prediction. Since this achievement, a rich toolbox provided by ultracold gases has become central to the study of quantum many-body physics. In this Insight we present an overview of some of the latest experimental advances that are pushing the field still further, expanding its influence across physics.

As discussed in the Comment by Jook Walraven, the achievement of Bose–Einstein condensation required a series of breakthroughs in the development of trapping, cooling and detection techniques. The rest of the collection is made up of Review Articles that show how fast the pace of progress has been. The fundamental methods needed to cool and probe ultracold gases have continued to improve, and new approaches to trapping and control have emerged. This suite of ultracold quantum technologies has reinforced the position of ultracold gases as the pre-eminent platform for studying collective quantum phenomena, while extending capabilities at the single-atom level.

It is not possible to do justice to a field as broad as ultracold gases in a single issue. In particular, there have been significant advances in engineering practical devices for applications including metrology and quantum computing, with commercial interest rapidly growing. We are sure that the collection of experimental technologies reviewed here will play a key role in these developments and in many fundamental and applied breakthroughs that are yet to come.


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