The 956th IMS colloquium
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Quantum Technology at 100 Billionths of a Degree Above Absolute Zero

Prof. Dana Anderson

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Date & Time：2022/6/28 (Tue.) 16:00-17:30
Place: IMS Research Building Room 201

To appreciate the potential of quantum technology one need only look to the recent progress in timekeeping technology. The state-of-the-art clock is a million times more precise than the instruments currently used to maintain the world's time standard. It is so precise, that it will tick differently when lifted by just a few millimeters because of the change in gravitational potential. These clocks are produced by cooling an ensemble of atoms to near absolute zero using laser light and other electromagnetic fields. At such low temperatures the behavior of atoms is governed by the laws of quantum mechanics rather than thermodynamics. The first such quantum matter, the Bose-Einstein condensate (BEC) was demonstrated in 1995. More than 25 years later, the cooling of atoms to a several billionths of a degree above absolute zero to produce quantum matter is now routine — sufficiently routine that one such system has operated for almost four years aboard the International Space Station.

Atom-based quantum technology spans applications from clocks to navigational systems, to radio-frequency detection, to imaging, to quantum computing, communications, and networks, to name some. In all case atoms are cooled, trapped, and manipulated using laser light and magnetic fields. I will provide an overview of this remarkable technology, its basic principles, and cover some of the most compelling applications.

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（IMS colloquium FY2022 committee）