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# *New approaches for neutral atom quantum technology*

**Date:** **2023/12/22 (Fri)**
**Venue:** **S4-208 (Online)**
**Time:** **13:00-14:30 (Taiwan)**

Abstract:
I will describe our journey that solved the 25 year old quest to create the first continuous-wave BEC, essentially the first continuous atom laser [1, 2, 3] and our follow-on work towards the first active superradiant optical clock. Looking ahead, neutral atoms have become a leading quantum computing platform with tabletop 1225 qubit processors [4] and 48 logical qubit, error corrected processors [5] demonstrated in just the past few weeks. Yet real world problems need millions of qubits which will require distributed quantum processors linked by a quantum internet [6]. I will propose and describe a new platform for quantum technology which combines the amazing success of neutral atom tweezers with the tunable long-range interactions possible in hybrid atom-nanophotonic systems [7]. This has the potential to enable applications like distributed neutral atom quantum processing, the first active superradiant optical clock, chip scale optical clocks, quantum memory and networking. I will finish with potential applications in fundamental physics ranging from quantum optics to new approaches for exploring dark energy.

[1] C.-C. Chen et al., Continuous Bose-Einstein condensation, Nature 606 683 (2022).
[2] C.-C. Chen et al., Chapter Six - The path to continuous Bose-Einstein condensation, Adv. In Atomic, Molecular and Optical Physics 72 361 (2023).
[3] S. Bennetts et al., Steady-State Magneto-Optical Trap with 100-Fold Improved Phase-Space Density, PRL 119 223202 (2017).
[4] P. Smith-Goodson et al., Atom Computing Announces Record-Breaking 1,225-Qubit Quantum Computer, Forbes October 24 (2023).
[5] D. Bluvstein et al., Logical quantum processor based on reconfigurable atom arrays, Nature (accepted), December 6 (2023).
[6] H.J. Kimble, The quantum internet, Nature 453, 1023 (2008).
[7] P. Solano et al., Chapter Seven - Optical Nanofibers: A New Platform for Quantum Optics, Adv. In Atomic, Molecular and Optical Physics 66 439 (2017).