Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3363** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Caustics in quantum many-body dynamics

Monday 6 June 2022 13:45 (15 minutes)

Caustics are singularities arising from natural focusing and are well known in optics but also occur in any system that has waves including water and quantum waves. Caustics take on universal shapes that are described by catastrophe theory and dominate wave patterns. My group has been extending these ideas to quantum fields, such as those found in the sine-Gordon and Bose-Hubbard models. Our physical motivation is to describe the dynamics of Bose-Einstein condensates (BECs) following a sudden quench, including the cases of two and three independent BECs that are suddenly coupled together.

Our theoretical simulations [1] of the dynamics of these low-dimensional many-body systems following the quench shows that caustics form in Fock space over time and this seems to be a generic phenomenon. Furthermore, the caustics are singular in the mean-field theory but are regulated and adopt universal interference patterns in the full many-body theory. These caustics represent a form of universal quantum many-body dynamics associated with singularities in the underlying classical dynamics.

[1] Caustics in quantum many-body dynamics, W. Kirkby, Y. Yee, K. Shi and D.H.J. O'Dell, Phys. Rev. Research 4, 013105 (2022).

Primary authors: O'DELL, Duncan; Mr SHI, Kevin (McMaster University); Dr KIRKBY, Wyatt (University of Innsbruck); Dr YEE, Yohan (University of Toronto)

Presenter: O'DELL, Duncan

Session Classification: M2-5 Degenerate Quantum Gases and Cold Atoms and Molecules (DAMOPC/DCMMP) | Gaz quantiques dégénérés, molécules et atomes froids (DPAMPC/DPMCM)

Track Classification: Technical Sessions / Sessions techniques: Atomic, Molecular and Optical Physics, Canada / Physique atomique, moléculaire et photonique, Canada (DAMOPC-DPAMPC)