



# **A mini-course on BEC and the Gross-Pitaevskii equation**

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**3 lectures: 13 May 2019 13:30-15:30**

**15 May 2019 13:30-15:30**

**16 May 2019 13:30-15:30**

**Perlman building, Lecture room 404**



## **Syllabus:**

- i. Basic properties of the Gross-Pitaevskii equation (GPE). Conservation laws, fluid formulation via Madelung transformation. Focusing and defocusing nonlinearity, positive and negative pressure. Quantum pressure.
- ii. De-Broglie waves. Bogolubov waves on condensate.
- iii. Modulational instability. Solitons.
- iv. Quantized vortices. Kelvin circulation theorem and its breakdown in GPE model. Vortex creation and annihilation. Vortex reconnections.
- v. Biot-Savart description for a tangle of quantized vortex lines. Superfluid turbulence.
- vi. Wave turbulence approach to superfluid turbulence. Four-wave interactions of de-Broglie waves. Dual cascade behavior. Kolmogorov-Zakharov stationary spectra. Nonequilibrium condensation and evaporation. Acoustic waves on background of condensate; 3-wave interactions.
- vii. Non-stationary spectra, self-similar evolution.

**Registration is free, but is required. Please send a message to [terry.debesh@weizmann.ac.il](mailto:terry.debesh@weizmann.ac.il) by 1 May 2019**