

# **Bose-Einstein Condensation of Light and Superfluid Phenomena**

**J.T. Mendonça**

*GoLP-IPFN, Instituto Superior Técnico, Universidade de Lisboa, Portugal*

We consider Bose-Einstein condensation of light, and its relation with superfluid phenomena. First discovered experimentally in dilute alkali gases in 1995, Bose-Einstein condensation was also recently demonstrated for photons, in 2010, using laser-pumped dye liquid in micro-cavities. In this new state of light, photons are in thermal equilibrium and satisfy a Bose-Einstein distribution.

Condensation of light was originally conceived in 1968, where photon cooling in astrophysical environments is provided by free electrons, instead of the dye-molecules of laboratory experiments. But this cooling process has not yet been observed experimentally.

Recent work in our group proposes the use of semiconductors and gaseous discharges, to allow for new types of cavity experiments, bridging the gap between the original astrophysical proposal and the current dye-cavity concept.

We also consider superfluid phenomena, and their relations with photon condensation. It is known that superfluids are insensitive to local obstacles, and similarly, superfluid light is insensitive to diffraction. Experiments with superfluid light can be performed using laser beam propagation in a nonlinear Kerr medium. Superfluid optical processes will be discussed.