Both the physics and the methods used for this investigation[5] lean very much on prior works on polaritons in inorganic semiconductors, where scattering-free flow[4] and vortex–antivortex nucleation[9] around a structural defect were observed. The key novelty is that it is now possible to study such features at room temperature and in a completely amorphous solid-state system with comparably high disorder.

However, the transition to the superfluid-like regime here is not sharp, which the authors largely attribute to the fact that their measurements integrate over a whole excitation pulse, taking the system from the normal to the superfluid regime and back.

The list of properties that make up a superfluid is much longer than reported here though. The out-of-thermal-equilibrium and driven-dissipative nature of polaritons also sets them apart from other quantum fluids like liquid helium and ultracold atomic gases. And it is arguable[10] to what extend they are real superfluids, if only a certain subset of superfluid-like behaviour is observed. Nevertheless, because of the temperature involved, these results will certainly stimulate debate. ❐

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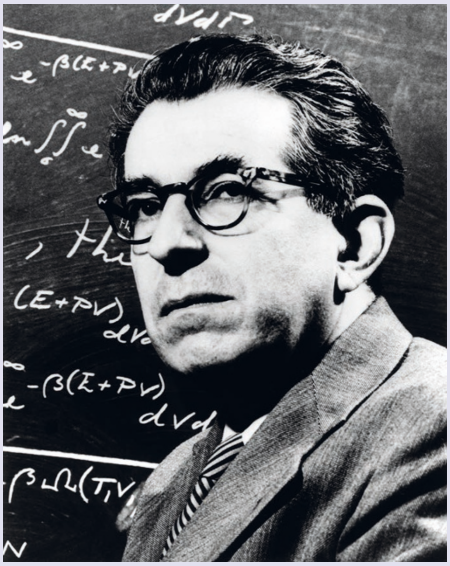
HISTORY OF PHYSICS

When quantum mechanics became huge

As the age of quantum technologies dawns, we've grown accustomed to the idea that quantum-mechanical effects can be apparent in practical devices. But long before the art of isolating, manipulating and measuring single quantum entities had been mastered, the concept of quantum phenomena on the macroscopic scale was well established for ensembles displaying collective behaviour, in particular superfluidity and superconductivity. The ground-breaking realization that macroscopic wavefunctions underlie these effects was introduced by Fritz London (pictured) in 1946. Daniela Monaldi now offers a fresh and insightful reconstruction of how London arrived at this unanticipated concept, and explains its inception as a synthesis of ideas assembled throughout a career characterized by many changes (*Stud. Hist. Philos. M. P.* http://doi.org/cbsk; 2017).

The list of London's seminal contributions is long and varied, from the quantum-mechanical bond theory of the hydrogen molecule, formulated with Walter Heitler, to the phenomenological relation between current density and magnetic field in superconductors, developed with his younger brother Heinz. He later worked on measurement theory, macromolecules and superfluidity, which



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occupied him until his untimely death in 1954, at age 54. But London's life was also one of constant dislocation: he was forced to leave Germany following the rise of the Nazis, moving to Oxford and later Paris, before emigrating to the US in 1939.

Against this backdrop of changes, Monaldi describes the emergence of the idea of macroscopic quantum mechanisms as the "layered result of a slow realization, not an early intuition or the goal of a pre-set agenda". As a key moment she identifies London's attendance of an international conference in Amsterdam in 1937, on the centenary of Johannes Diderik van der Waals's birth. Discussion points at the meeting included the λ-transition in helium, as well as George Uhlenbeck's retraction of his earlier criticisms of Albert Einstein's work on boson condensation. London then worked to reformulate Bose–Einstein condensation — which had, he felt, gained the reputation "of having only a purely imaginary existence" — and later connected it to the λ-transition (convinced, after strong initial scepticism, by László Tisza).

Monaldi sees this phase in London's career as the turning point in his formulation of concepts that eventually unified superconductors, superfluid helium and Bose–Einstein condensation, to show that quantum mechanisms are not confined to the microscopic realm, but can "directly reach into the macroscopic world". London finally presented his idea in July 1946 at a conference in Cambridge, UK, the first major international physics meeting after the war — reconnecting with the broader community from across the oceans.

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