

Special Issue
International Conference
Louis de Broglie Days 2023

100 YEARS OF MATTER WAVES
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1 Introduction: Celebration of the 100th birthday of Louis de Broglie's contributions to the quantum theory.

100 years ago, Louis de Broglie, faced with the crisis of the physics of his time, proposed a hypothesis which, in the words of Einstein, “lifted a corner of the great veil”. This hypothesis, the existence of matter waves, will constitute the starting point of modern quantum mechanics.

The aim of the conference was to commemorate L. de Broglie's 3 articles on matter waves published in 1923 with 3 days of presentations and discussions on the contemporary aspects of matter waves.

We addressed topics ranging from the state of the art concerning the observation of matter waves (macro-molecules, atomic interferometry and cold atoms, electron optics and neutronics), to fundamental questions concerning the nature of these waves, as well as presentations discussing technological applications or giving a historical perspective.

2 Conference program.

The conference program was the following.

2.1 3rd of July's session

Morning:

- Opening of the conference by the organisers (also editors of this special issue).

Opening Remarks

- Markus Arndt (Univ. Vienna)

Universal Matter-Wave Interferometry

- Michael Berry

Quantum trajectories, quantum potential, superoscillations: Bohm, Madelung, de Broglie, Newton

- Ido Kaminer (Technion, Haifa)

Free-electron quantum optics

- Arnaud Landragin (SYRTE, CNRS Paris)

Atomic interferometry based inertial sensors

- Patrick Peter (CNRS, Inst. d'Astrophysique de Paris)

Trajectories in quantum cosmology

- Gabriel Dutier (LPL, Univ. Paris-13)

Atomic diffraction through a material grating

Afternoon.

- Elena Magdalena Staicu Casagrande (ISMO, Univ. Paris-Saclay)

Fast Atom Diffraction from crystalline surfaces at femtometer wavelengths: where is the quantum limit?

- Ward Struyve (KU Leuven)

Cosmic acceleration as a quantum gravity effect

- O. Darrigol (Sphere, CNRS, Paris)

Louis de Broglie's discovery of matter waves

2.2 4th of July's session

Morning:

- H. Batelaan (Univ. Nebraska, Lincoln)
Quantum force and space-time topology in the Aharonov-Bohm effect
- H. Lepine (ILM, CNRS Lyon)
Attosecond scattering delays in photo-ionized molecules
- R. Folman (Ben Gurion Univ, Beer Sheva)
Stern-Gerlach Splitting and Wave-Particle Duality, Re-combined
- D. Fargue & C. Daviau (Institut L. de Broglie, Paris)
The association of wave and particle aspects in the works of Louis de Broglie and his collaborators, and novel developments

Afternoon.

- A. Gauguet & J. Vigué (LCAR, Toulouse)
Macroscopic scale matter wave interferometers for exploring quantum physics
- D. Das (University College London)
Mass-independent test of quantumness of a massive object
- D. Shanahan (The University of Sydney)
What is a matter wave? Revisiting the famous thesis of 1923
- M. Giammarchi (INFN Milano)
Antimatter Quantum Interferometry
- C. Kojima (Nihon Univ., Tokyo)
Influence of Louis de Broglie's Matter Wave Theory on Japanese physicists
- **Poster session**

2.3 5th of July's session

Morning:

- S. Guellati-Khélifa (LKB, Paris)
Testing the standard model using atom interferometry
- B. Hiley (Birkbeck, London)
Inertial mass, rest mass and the quantum potential: de Broglie's pioneering work on conformal rescaling
- H. Abele (TU Wien)
A quantum bouncing ball gravity resonance spectrometer
- A. Valentini (Clemson Univ.)
Beyond the Born rule in quantum gravity

Afternoon.

- A. Steinberg (Univ. Toronto)
Fluctuat nec Mergitur - atom waves tunneling, spinning, colliding, and resonating in structures made of light
- J. Croca (Univ. Lisboa)
De Broglie's Causal Research Realistic Program and the Lisbon School
- L. Brenig (Univ. Libre de Bruxelles)
A bridge between Schrödinger equation and Schrödinger Bridge process
- T. Northup (Univ. Innsbruck)
Levitated nanoparticles: the road ahead to macroscopic superpositions
- P. Pelcé (Irphé CNRS, Marseille)
From "La Nouvelle Théorie de la Lumière" to the quantum relativistic equations for two particles

- S. Das (University College London)

Double-slit experiment remastered

The present special issue follows this busy one-day workshop. It contains the contributions of some speakers but also spontaneous contributions following the call for contributions addressed to all participants and diffused on a large network.

More information about affiliations, abstracts and posters can be found on the website <https://debroglie2023.sciencesconf.org/>.