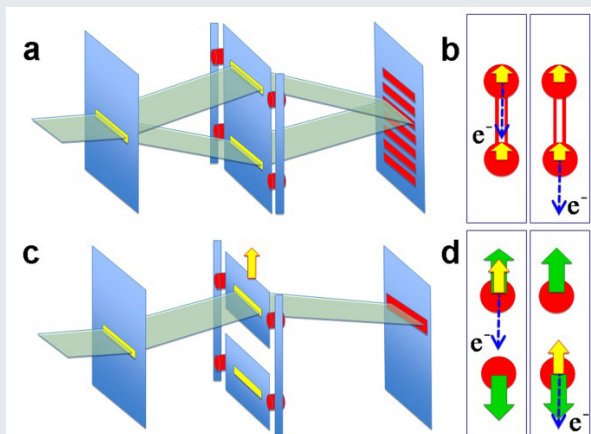


Einstein-Bohr gedanken experiment performed at the molecular level

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For the first time, an almost centenary thought experiment proposed by Albert Einstein and Niels Bohr in their discussion on whether the elementary particles constituting our surrounding world should be seen as particles or waves, was successfully realized at the molecular level (O_2), by synchrotron based experiments. This result is adding a new cornerstone to one of the richest public debates in the history of Science, triggered by the original recoiling double-slit gedanken experiment, which has already led to several Nobel Prizes. We showcase a materialization of this gedanken experiment by resonant X-ray photoemission from molecular oxygen for geometries near equilibrium (coupled slits), and in a dissociative state far away from equilibrium (decoupled slits). Interference is observed in the former case, while the electron momentum transfer quenches the interference in the latter case owing to the Doppler labelling of the counter-propagating atomic slits, in full agreement with Bohr's complementarity.



Schematic representation of the double slit gedanken experiment, with coupled (a) and decoupled (c) massive slits, and the schematics of the materialization of this thought experiment using a molecular photoionization experiment where the two slits are replaced by two coupled (b) and decoupled (d) oxygen atoms. The recoil momenta and the propagation directions of the dissociating atoms and electron are shown schematically by yellow, green and dashed blue arrows, respectively

X-J. Liu, Q. Miao, F. Gel'mukhanov, M. Patanen, O. Travnikova, C. Nicolas, H. Ågren, K. Ueda & C. Miron, *Einstein-Bohr recoiling double-slit gedanken experiment performed at the molecular level*, *Nature Photonics*, 9 (2) 120-125 (2015)

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