High Contrast de Broglie Interference of Fullerenes

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Recently we were able to show de Broglie wave interference of the fullerenes C_{60} and C_{70} at a free standing material grating [1]. This proves that it is possible to preserve quantum coherence almost completely in the external degrees of freedom of a hot, massive and complex object over a long time and distance. The fullerenes were produced in a thermal source which was kept at about 900 K. At such a high temperature many internal degrees of freedom are excited and the molecules may emit a few infrared photons (blackbody radiation and vibrational quanta) during their time of flight through the apparatus. Our published measurements were essentially consistent with the absence of decoherence during the time of flight of the molecules. The interference contrast in all experiments has however been limited by the thermal velocity spread and the finite collimation of the fullerene beam. Meanwhile we were able to improve our source and to increase the detected fullerene flux. This enables us to perform measurements with a finer collimation as well as a velocity selected fullerene beam. The improved interference contrast allows us to give more stringent limits on possible decoherence effects in our experiments.

[1] Markus Arndt, Olaf Nairz, Julian Voss-Andreae, Claudia Keller, Gerbrand van der Zouw, Anton Zeilinger, *Nature* **401** 680 (1999).