

Macroscopic quantum superpositions to test quantum gravity: References

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Lecture 1:

- Most macroscopic superposition: molecules with 2000 atoms [1]
- COW experiment: Neutron interferometer measures phase shift due to gravitational potential [2]
- Early quantum gravity work from Matvei Bronstein [3-5]
- Feynman thought experiment on page 250 [6]
- Double-interferometer experiment to test quantum gravity [7, 8]

References:

- [1] Y. Y. Fein, P. Geyer, P. Zwick, F. Kiałka, S. Pedalino, M. Mayor, S. Gerlich & M. Arndt, Quantum superposition of molecules beyond 25 kDa, *Nature Phys.* **15**, 1242 (2019).
- [2] R. Colella, A. W. Overhauser & S. A. Werner, Observation of Gravitationally Induced Quantum Interference, *PRL* **34**, 1472 (1975).
- [3] M. P. Bronstein, Translated republication of: Quantum theory of weak gravitational fields, *Gen. Relativ. Gravit.* **44**, 267 (2012).
- [4] G. E. Gorelik, Matvei Bronstein and quantum gravity: 70th anniversary of the unsolved problem, *Physics-Uspekhi* **48**, 1039 (2005).
- [5] M. P. Bronstein, Quantentheorie schwacher Gravitationsfelder, *Phys Z Sowjetunion* **9.2-3**, 140 (1936).
- [6] D. Rickles & C. M. e. DeWitt, The Role of Gravitation in Physics: Report from the 1957 Chapel Hill Conference, <https://edition-open-sources.org/sources/5/index.html> (2011).
- [7] S. Bose, A. Mazumdar, G. W. Morley, H. Ulbricht, M. Toroš, M. Paternostro, A. A. Geraci, P. F. Barker, M. S. Kim & G. Milburn, Spin Entanglement Witness for Quantum Gravity, *PRL* **119**, 240401 (2017).
- [8] C. Marletto & V. Vedral, Gravitationally Induced Entanglement between Two Massive Particles is Sufficient Evidence of Quantum Effects in Gravity, *PRL* **119**, 240402 (2017).