



Contribution ID: 236

Type: **Talk**

## Weak measurements and light-matter interactions

*Friday 11 September 2020 10:00 (30 minutes)*

Unlike projective measurements, weak measurements [1] enable to gather slight information about the measured system while avoiding in most cases its collapse. This unique property, enabled by the loose coupling between the measuring apparatus and the measured system, has opened up a plethora of conceptual and practical applications. After a brief introduction to this topic, partially based on our previous works [2,3,4], I will present a recent experimental work [5], where we realized for the first time variable-strength measurements in a trapped ion system. Our analysis shows that the weak-to-strong transition relies on a dimensionless coupling parameter related to the system-apparatus interaction. Further implications, as well as the related quantum-to-classical transition in free electron systems [6] will be discussed as well. These latest works create a connection between the quantum measurements formalism and the world of light-matter interactions, enabling to describe the latter in terms of the former.

### References:

- [1] Y. Aharonov, D.Z. Albert, L. Vaidman, How the result of a measurement of a component of the spin of a spin-1/2 particle can turn out to be 100, *Phys. Rev. Lett.* 60, 1351 (1988).
- [2] B. Tamir, E. Cohen, Introduction to weak measurements and weak values, *Quanta* 2, 7-17 (2013).
- [3] Y. Aharonov, E. Cohen, A.C. Elitzur, Foundations and applications of weak quantum measurements, *Phys. Rev. A* 89, 052105 (2014).
- [4] F. Piacentini et al., Measuring incompatible observables of a single photon, *Phys. Rev. Lett.* 117, 170402 (2016).
- [5] Y. Pan, J. Zhang, E. Cohen, C.-W. Wu, P.-X. Chen, N. Davidson, Observation of the weak-to-strong transition of quantum measurement in trapped ions, accepted to *Nat. Phys.*, arXiv:1910.11684.
- [6] Y. Pan, E. Cohen, E. Karimi, A. Gover, I. Kaminer, Y. Aharonov, Weak measurement, projective measurement and quantum-to-classical transitions in electron-photon interactions, arXiv:1910.11685.

### Is this abstract from experiment?

No

### Internet talk

Yes

### Name of experiment and experimental site

This is an experimental work performed at the National University of Defense Technology, China

### Is the speaker for that presentation defined?

Yes

## Details

Eliahu Cohen, <http://www.eng.biu.ac.il/cohenel4/>

**Primary author:** Dr COHEN, Eliahu (Bar-Ilan University)

**Presenter:** Dr COHEN, Eliahu (Bar-Ilan University)

**Session Classification:** Plenary