Guest talk on 05.03.2026 by
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Absorption-free detection of objects inside an optical cavity

Interaction-free measurements were originally conceived as thought experiments to elucidate the measurement problem in quantum mechanics, e.g. those by Renninger [1] and Dicke [2]. Elitzur and Vaidman [3] used the term to describe a scheme where the presence or absence of a perfectly absorbing object in one arm of an optical interferometer is inferred without a single photon being in its vicinity. After a brief overview of these different meanings and setups, I will show how a Fabry-Pérot cavity can be optimized to detect a semi-transparent object placed inside it, or confirm its absence, while avoiding absorption. In particular, contrary to the case of a perfect absorber, there are regimes where an undercoupled cavity is favorable [4]. Finally, I will discuss if and when such a dectection can be considered interaction-free in the sense of Elitzur and Vaidman.

References

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4. V. Vujnović, N. Kralj, and M. Karuza, "Detection of a semitransparent object with no exchange of quanta," Opt. Express 33, 1385-1393 (2025).