Quantum sensing of time dependent electromagnetic fields with single electron excitations

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Abstract

In this talk, I will discuss the potential of electronic interferometers for probing the quantum state of electromagnetic radiation on a chip at sub-nanosecond time scales. We propose to use single electron excitations propagating within an electronic Mach-Zehnder interferometer in the Aharonov-Bohm dominated regime. We will discuss how information about the quantum state of the electromagnetic radiation is encoded into the interference contribution to the average outgoing electrical current. Furthermore, we present specific examples showing that our method has the potential to measure properties of quantum radiation in both the time and frequency domains. We finally discuss how shaping techniques of single electron wave-packets can be used to obtain the strongest signal associated with the external radiation. The development of these techniques could have significant implications for probing the fundamental properties of electromagnetic radiation on short time scales in the microwave and tera-Hertz domains.

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