Can quantum correlations improve radar technology?

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In the last decade, following the pioneering work from Tan *et. al* [1] on *quantum illumination*, a lot of research activity explored the possibility of improving target detection performances exploiting quantum radiation. The main idea of quantum illumination is to exploit a quantum process to create microwave pulses with correlations which are stronger than that allowed by classical electromagnetic theory, and to profit from these quantum correlations to efficiently reject thermal noise.

On the one hand, quantum illumination is remarkably interesting from the fundamental point of view: it is the only known quantum protocol where a quantum advantage is achieved even though thermal noise and losses washes away all quantum properties of the transmitted radiation. On the other hand, the regime where this quantum advantage can be obtained is fundamentally restricted to very low transmitted signal intensities, a fact that dramatically affects the practical applicability of quantum illumination protocols.

In my presentation, following our tutorial [2], I will introduce the basic of quantum illumination in a language accessible to radar engineer. I will explain the origin of the quantum advantage provided by this protocol, and point out its practical limitations.

[1] S. H. Tan, *et al.* "Quantum illumination with Gaussian states." *Physical review letters* 101.25: 253601 (2008).

[2] G. Sorelli, F. Grosshans, N. Treps, F. Boust, "Detecting a target with quantum entanglement.", IEEE, AES Magazine (early access).