Invited Paper

Recent progresses in quantum imaging real applications

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ABSTRACT

We present two recent results achieved in INRIM laboratories paving the way for next future commercial use of quantum imaging techniques. The first exploits non-classical photon statistics of single nitrogen-vacancy color centers in diamond for realising super-resolution. A little more in detail we demonstrate that the measurement of high order correlation functions allows overcoming Abbe limit. The second exploits ghost imaging in a specific case of practical interest, i.e. in measuring magnetic structures in garnets.

Keywords: Super-resolution, ghost imaging

1. INTRODUCTION

In the last decade, a stream of enhanced measurement techniques exploiting counter-intuitive properties of quantum light[1,2] has found successful application in many noteworthy practical situations, from interferometric measurements aimed to the detection gravitational waves and quantum gravity effect,[3,4] to biological particles tracking[5] and phase contrast microscopy.[6] A major field in which quantum enhanced techniques have shown fruitful application is imaging[7,8] and in this work we describe two novel ground-breaking imaging schemes using non-classical properties of light and correlated light beams realized at Istituto Nazionale di Ricerca Metrologica (INRIM). The first application[9] is the super-resolved imaging of single Nitrogen-Vacancy centers in diamond obtained by exploiting photon anti-bunching behavior. In the following we will show how this technique allows to surpass the diffraction limit in confocal microscopy. The second one[10] is the magneto-optical ghost imaging of domain structures in magnetic materials.

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