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Subwavelength focal depth enrichment for magnetic recording using specially designed phase plate

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We propose to use pure-phase filter in combination with high NA lens axicon to achieve a uniform magnetization depth illuminated by a circularly polarized Bessel Gaussian beam. The magnetization distributions are derived and evaluated based on the vector diffraction theory and the inverse Faraday effect of the Isotropic and non-magnetically ordered material .With this kind of system, the Depth of Focus (DOF) is increased to 12.2 λ and the spot size has been reduced to 0.36 λ. This increased DOF and decreased spot size will be very useful in all optical magnetic recording applications.

Introduction: It is observed that the circularly polarized light should have the ability to act upon a magnetic system in a way similar to a magnetic field directed parallel to the wave vector of the light via the inverse Faraday Effect [1-2]. It is well known that Bessel beams are solutions of the Helmholtz equation, and have attracted a lot of attention [3-4].

Results & Discussion: For all-optical magnetic storage, higher recording density is possible only by achieving a small magnetic spot. The generation a magnetic focal spot in the focal region of high NA lens is shown in Figure 1(a). Similarly, the generation of magnetic focal spot in the focal region of high NA lens axicon is shown in Figure 1(b). Inorder to increase the focal depth the quality of generated focal structure phase filter is introduced. However, it is observed that phase filter techniques can reduce the magnetic focal point, meanwhile increases the depth of focus (DOF) of the field simultaneously. Here, a new technique is demonstrated which uses a five-belt phase plate in combination with a high NA lens axicon to achieve a uniform magnetization depth which maintains the super resolution and it is shown in Figure 1(c).

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