

SEMINAR: Up-conversion of non-trivial optical phase structures through four-wave mixing in atomic gases

DANIEL SAHAGUN SANCHEZ

July 09, 2024

15:00 to 16:00

Blue Lecture Room

I will talk about first generation of quasipropagation-invariant beams by inducing four-wave mixing in atomic gases. This was done by exciting the $5S_{1/2} \rightarrow 5P_{3/2} \rightarrow 5D_{5/2}$ double transition followed by the $5D_{5/2} \rightarrow 6P_{3/2} \rightarrow 5S_{1/2}$ cascade decay of Rb^{87} . The later yields a bright collimated-blue light that can be detected with simple CMOs cameras. The first pump beam had a Gaussian profile whereas the second one was prepared with Mathieu-Gaussian modes, also solutions of the Helmholtz equation. In a first set of experiments the second pump optical field had imprinted odd and even Mathieu structures, carrying elliptical angular momentum. By analysing the configuration and Fourier spaces of the collimated blue light it was quantitatively verified that the atoms had replicated the incoming modes, including their dynamical variables [1]. In a subsequent series of experiments the second pump beam was prepared with helical Mathieu-Gaussian modes, that contain arrays of optical singularities. The up-conversion of their information to the collimated blue light has verified by firstly applying the two techniques introduced in [1]. Following, the presence of the optical vortices was probed with a Michelson interferometer [2].

[1] Mendoza-Lopez, L. A. et al. Generalized angular momentum transfer to up-converted photons via four-wave mixing in atomic gases. *Phys Rev Res* 3, 033170 (2021)

[2] Mendoza-Lopez, L. A. et al. Frequency Conversion of Optical Vortex Arrays Through Four-Wave Mixing in Hot Atomic Gases. *Front. Phys., Sec. Quantum Engineering and Technology* 10:895023 (2022)

Hosted by: Academic Affairs