Director de tesis CIO: Dr. Roberto Ramírez Alarcón
Director de tesis UD: Dr. Qiwen Zhan

Sinodales:

Dr. Carmelo Guadalupe Rosales Guzmán
(Sinodal Interno, Secretario)

Dra. Laura Elena Casandra Rosales Zárate
(Sinodal Interna, Vocal)

Dr. Qiwen Zhan
(Director de tesis UD, Presidente del Jurado)

Tesis: "ELLIPTICAL VORTEX BEAMS THROUGH TURBULENT ATMOSPHERE"

## Resumen:

In this work, simulations of propagation of helical Ince-Gauss beams, elliptical solutions of the paraxial wave equation that carry orbital angular momentum, were performed in order to investigate how the nature of these modes affect their performance as information carrying beams in free space optical communication systems. Special attention was given to the effects that the order p, degree m and ellipticity ε parameters, and their evolution, have on the robustness of the beam. We find that for a given mode, the chose of basis in which it is projected (ellipticity value) does not strongly affect the light spatial mode performance as information carrier. However, for a chosen helical Ince-Gauss mode, it is rather more strongly affected by the combination of p and m and their difference p − m. These results were obtained by varying propagation parameters such as the refractive index structure parameter C 2n or propagation distances and using different beam structure parameters as the mentioned p, m and ε. From the simulations, both intensity and phase transverse profiles were calculated as well as propagation measurements such as the fidelity of the modes, and specially defined scintillation index and strehl ratio. Additionally, the generation of these vortex beams using spatial light modulators was demonstrated, showing the evolution of the transverse intensity profile of the modes with the ellipticity ε parameter. From this, a detection scheme of these modes is proposed using their near-field intensity profile.