

Multifocal kinoform diffractive lenses based on the aperiodic Silver Mean sequence

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Abstract

In this communication, we present a new kind of diffractive-kinoform lenses characterized by the phase distribution of the Silver Mean (SM) sequence. The focusing properties of these aperiodic lenses are analytically studied. It is shown that, under monochromatic illumination, the SM lenses direct most of the incoming light into four foci whose focal lengths are related to the Silver ratio. Two different photonics applications are proposed.

First, we present the implementation of multi-trap optical tweezers. We show that The quadrifocal-kinoform feature of the SM lenses enables multiple axial trapping, providing an alternative method for

three-dimensional manipulation. Positioning particles along a line at controlled distances allows for the exploration of interactions between them under laser irradiation.

Second, we propose the application of this approach in ophthalmology to design a multifocal intraocular lens. Multifocal lenses are currently the most popular surgical alternative for correcting presbyopia and cataracts. We show that under broadband illumination, the superposition of the different foci creates an extended depth of focus in the intraocular lens.

Finally, the application of this type of aperiodic lens in other fields, such as microscopy or quantum computing, is also suggested.

Biography

Dr. Walter D. Furlan received his PhD in Physics from the National University of La Plata (Argentina) in 1988. He is now Professor of Optics at the University of Valencia (Spain) since 2010. His research spans the field of Optics, initially focusing on phase-space formalisms and later on the design and applications of diffractive optical elements with aperiodic geometries.: He is currently the co-director of the "Diffractive Optics Group", where the research primarily targets the design of structured diffractive lenses and their applications in optical trapping and ophthalmology.