Ali Mardan Dezfouli

Personal Information

URL	https://www.researchgate.net/profile/Ali_Dezfouli
Address	Institut za fiziku, Room III–136, Bijenička46, 10000 Zagreb, Croatia
Email	amdezfouli@ifs.hr
Mobile	+385 (0) 95 712 1280
Phone	+385 (0) 1 469 8902
Birth	13th Feb 1990, Ahvaz, Iran

Education and Activities

Since 2021	**Ph.D. in Physics,** Institut za fiziku, Zagreb university, Zagreb, Croatia Experimental Optics
2017-2020	**Research Assisstant,** Institute for Advanced Studies in Basic Sciences, Optics Research Center, *Zanjan, Iran*
2014–2017	**M.Sc in Optoelectronic Engineering(Laser)**, *Maleke-Ashtar University of Technology*, Isfahan, Iran.
2010–2014	**B.Sc in Phyiscs**, *The University of Zanjan*, Zanjan, Iran. Solid state physics
2005–2009	**Diploma**, *Payam Enghelab school (National Organization for Development of Exceptional Talents)*, Ahvaz, Iran mathematics and physics

Master Thesis

Title	*Generation, propagation and characterization of laser beams carrying orbital angular momentum for classical information application.*
Supervisors	Dr. Abolhasan Mobashery
Description	The motivation was to investigate methods for characterization orbital angular momentum(OAM) state of light (please see accomplished projects.)

Bachelor Thesis

Title	*A new permanent magnetic lattice for ultracold atoms and Bose-Einstein Condensates.*
Supervisors	Dr. Saeed Ghanbari
Description	In this thesis, we worked on a new permanent magnetic chips which can hold ultracold atoms for application in quantum information. (Please see accomplished projects).

Publication List

2019 Theory of diffraction of vortex beams from structured aperture and generation of elegant elliptical hermite-gaussian beams.

Davud Hebri, Saifolah Rasouli, ***Ali Mardan Dezfouli****,*

J.Opt.Soc.Am. A → DOI: 10.1364/JOSAA.36.000839

Abstract: In this work, a comprehensive analytic study of the diffraction of vortex beams from structured apertures is presented. We formulate the near- and far-field diffraction of a vortex beam from an aperture having an arbitrary functionality in the Cartesian coordinates by two general and different approaches. We show that each of the resulting diffraction patterns can be determined by a number of successive derivatives of the 2D Fourier transform of the corresponding hypothetical aperture function or equally can be obtained by a summation of 2D Fourier transforms of the corresponding modified aperture function. We implement both introduced analytic approaches in predicting the diffraction of a vortex beam from an elliptic Gaussian aperture, an elliptic Gaussian phase mask, and a hyperbolic Gaussian phase mask in the near- and far-field regimes. It is shown that the predicted diffraction patterns by both these approaches are exactly the same. It is shown that the diffraction of a vortex beam from an elliptic Gaussian aperture at the far-field regime forms a light beam that belongs to a family of light beams we call elegant elliptical vortex Hermite–Gaussian(EEVHG) beams. In addition, the diffractions of a vortex beam from a Fresnel zone plate in general form for the on- and off-axis situations are formulated, and sinusoidal and binary zone plates are investigated in detail. Our general analytic formula can be used for a large variety of apertures including off-center situations and asymmetrical cases. EEVHG beam can be used in manipulating micro-particles.

2020 Efficient characterization of optical vortices via diffraction from curved-line linear grating.

Pouria Amiri, ***Ali Mardan Dezfouli****, Saifolah Rasouli.*

J.Opt.Soc.Am. B → DOI: 10.1364/JOSAB.398143

Abstract: The diffraction from a linear grating having a quadratic curvature on its lines is proposed for vortex beam characterization. Three types of transmission functions are considered for the gratings, including pure amplitude, pure phase, and hybrid amplitude and phase profiles. The first order diffraction of the vortex beam through such gratings, is only a set of elongated intensity spots. The number of spots determines the value of topological charge (TC) and the sign of TC can be distinguished with the elongation (and rotation) direction of the spots. This method is effective because all of the energy of the beam transfers into the bright bar-like spots. Another advantage of the method is its ease of use, because it is not sensitive to the relative location of the beam axis and the grating center.

Using spatial light modulator we provide different hybrid amplitude and phase linear gratings with a quadratic curvature on their lines and demonstrate the effectiveness of the proposed method, experimentally. It is shown that for given values of the lateral shear, one of the first-order diffraction patterns is eliminated and the intensity of the order one is maximized. Finally, we present the key results of the diffraction of optical vortices from annular amplitude and phase gratings, and from phase objects having linearly increasing phase functions along the radial direction. It is shown that, the diffraction of optical vortices only from the parabolic-line linear gratings is insensitive to the off-axis value of the beam and grating centers. Our method is very efficient and low cost and can be used in free space optical communication systems.

Awards

2013 Selected by Iranian ministry of science(from entrance exam) for master in photonics at institute of advanced studies in basic sciences(IASBS), Iran

2017 Top graduated student in master

2020 My publication in JOSA B has been highlighted by OSA in Spotlight on Optics as one of the two selected papers in October

Scientific Visits

2016 International workshop on ‘’structured light and matter, concept and applications’’, IASBS, Iran

2019 Scientific workshop on the occasion of the international day of light, Tarbiat Modares university, Iran

Languages

Persian **native**

English **fluen- IELTS certification with overall score: 6.0(S=7, W=6, L=6, R=6)**

German **intermediate(A2)**

List of Referees

1. Dr. Saeed Ghanbari: University of Zanjan, Iran.
Email: sghanbari@znu.ac.ir

2. Dr. Abolhasan Mobashery: Maleke-Ashtar University of Technology, Iran.
Email: mobashery59@yahoo.com

3. Dr .Saifollah Rasouli: Institute of Advanced Studies in Basic Sciences(IASBS), Iran
Email: rasouli@iasbs.ac.ir

Accomplished Projects

Master study

My study was related to complex light fields and specially light field having phase singularity, polarization singularity, and beams having non-diffractive properties, and beams carry orbital angular momentum(OAM). Such beams are applicable in a wide range of areas in quantum optical communication, optical tweezers, micromanipulation, optical metrology, optical imaging, microscopy, bio-photonics, laser welding, nonlinear photonics, adaptive optics.
I started my work by using computer generated holography(CGH) method, manufacturing amplitude holograms, and changing them to phase hologram since the quality of the hologram were low the efficiency of generated beam was low, for the next step, I worked on interferometry and diffraction of such beams for characterization of orbital angular momentum(OAM) of light.
Shortly after graduating from master, I received a fund from Iran National Science Foundation in affiliation and on demand of advanced laser beam shaping based on spatial light modulator(SLM), in a cooperation with Dr.Mohammad Yeganeh from optics research center of Zanjan. Due to high cost of SLM few labs could provide this device so there was a high demand on a low cost SLM for optical information processing and optical phase modulation of input beams. In this theme, our main focus was on accomplishing the project at a low cost using a LCD video projector, by designing and analysis of electro-optical systems, planning and evaluation of components in a logical plot, modeling of optical and electrical testing elements, and study of composite system framework, devising and establishing specific schemes to disassemble and assemble device in efficacious and low cost configuration. Then by displaying the gray scale image the quality of produced beams were enhanced by using different programming algorithm for optimum phase modulation for a red and green wavelengths with good beam quality factor. In this scheme, optical vortex, bessel-gaussian beam, airy beams were generated successfully. Then I was able to propose new methods for evaluation of optical vortex and also we were able to generate a new beam which we called as Elegant Elliptical Vortex Hermite-Gaussian(EEvHG) in this research, where such beam can be used in optical tweezers setup since one can control optical singularities. Likewise, a complete description of light field having singularities from fresnel zone plates, was formulated.(Please check my published paper in JOSA A for more information)
In another project, in a cooperation funded by telecommunication unit on demand of a method for measuring orbital angular momentum of light for free space optical communication, I worked on ways to tackle this issue in a technical way. In this scenario, I proposed a new 2D periodic diffraction grating for evaluation of the OAM of unknown input beam having phase singularities after a short propagation. I did experimental works in two way using passive holograms and digital holograms to obtain the results. For the first time we show that by using our method we can characterize unknown beam without any spatial alignment on spatial light modulator or any dependency on angle of input OAM mode. This method is very versatile and very low cost and very efficient. We show that the effect of a lateral shearing between the amplitude and phase parts of the hybrid grating on the resulted diffraction pattern. It is shown that for given values of the

lateral shear, one of the first-order diffraction patterns is eliminated and the intensity of the order one is maximized. This parabolic grating is not sensitive to the angle of incidence of light and can be used for free space optical communication systems. .(Please check my published paper in JOSA B for complete information).

Bachelor study

I did research on ultra-cold atoms, and working on new atom chip to confine ultra-cold atoms and Bose-Einstein-Condensation(BECs) using permanent magnetic materials. The motivation was to introduce a magnetic lattice with nonzero minima which can be fabricated more conveniently compared with the previous ones and perhaps can be used as a new platform to perform quantum computation with cold atoms. We were able to obtain the minima of magnetic field and also trap frequencies for ultra-cold atoms having parallel permanent magnetic bar. We showed that, for a certain neighbouring between magnetic bars having special shape, we can have high frequency trap for BEC.

Teaching Experiences

2016-2017	Computational fourier optics courses for photonics student, Maleke-Ashtar University of Technology, Iran
2015-2016	English courses for engineering students, Maleke-Ashtar University of Technology, Iran
2011-2012	Physics lab assistant, Zanjan University, Iran

Professional Experience

- Programming in MATLAB, MATHEMATICA, LABVIEW, ZEMAX, C++,
- Evaluation of new technologies, pursue innovative solutions. Plan and conduct test of new technologies under evaluation in team. Execute feasibility studies of new technologies and provide results/analysis supporting the decision making process. Execute feasibility studies of complete systems/ sub systems, leveraging new design concepts. Prepares the demonstration of new capabilities and conduct performance analysis.
- knowledge of a broad range of optics including, imaging, illumination, fourier optics, interferometry, geometric optics, quantum optics, quantum information, polarization, spectroscopy, optical manipulation. Working knowledge of different laser sources, optical materials, liquid crystals. Knowledge of passive holography and digital holography for advanced wavefront shaping, and generation of complex light field for various applications in optical communication, optical metrology, optical micro manipulation, optical imaging
- Working knowledge of optical transmission and optical communication systems in turbulance
- Design and performance analysis of systems, budgeting of systems and/or component performance parameters, modeling of optical testing configurations, and participation in system integration/alignment

- Contribute to the development, and support, and continues improvement of our automated test infrastructure based on object oriented programming
- Design optical test algorithms and implement them in modulator test programs for validating the system optical performance
- Design and development of new products, features and/or systems that integrates advanced lighting technology and wavefront beam shaping.
- Investigate, develop and prototype new practical concepts, processes and applications that will raise company's competitive position with the intent of commercializing the technology
- Educate co-workers on developed technologies
- Interface with Material Suppliers to establish advanced material direction for the design and development of current and future products.
- Identifies and Pursues new products concepts for development through benchmarking activities
- Support/Develops Project Costs and Timing Constraints
- Assist in the protection and execution of intellectual property
- Collaborates with scientists and mechanical, electrical and software engineers to maintain and modify unique tools necessary for industrial unit and the ability to communicate with business units

Completed research projects

- Building spatial light modulator for advanced complex wavefront shaping(Funded by Iran National Science Foundation)
- High capacity free space laser communication link establishment(Funded by Telecommunication Company of Iran)

Other activities

- Web site development ability
- Working with Microsoft Office, Power Point

Hobbies

- ✓ Traveling, surfing web, philosophy, sport, music