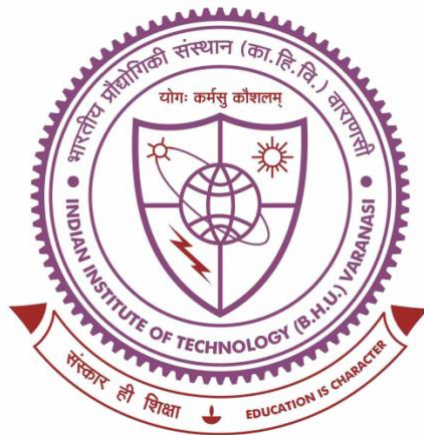


Quantitative imaging through scattering wall and fog using statistical analysis and holography



**Thesis Submitted in Partial Fulfillment for the
Award of the Degree of
Doctor of Philosophy**

By

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2024

Dedicated To My Beloved Parents

“Everything I am and aspire to become is a reflection of my parents' love, sacrifices, and unwavering support”



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I, **Sourav Chandra**, certify that the work embodied in this thesis is my own bona fide work carried out by me under the supervision of **Prof. Rakesh Kumar Singh** and co-supervision of **Dr. Rajeev Singh** from **July 2019** to **December 2024**, at the **Department of Physics**, Indian Institute of Technology (BHU), Varanasi. The matter embodied in this thesis has not been submitted for the award of any other degree/diploma. I declare that I have faithfully acknowledged and given credit to the research workers wherever their works have been cited in my work in this thesis. I further declare that I have not willfully copied any other's work, paragraphs, text, data, results, *etc.*, reported in journals, books, magazines, reports dissertations, thesis, *etc.*, or available on websites and have not included them in this thesis and have not cited as my work.

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This thesis is dedicated to all those who have faced the storms of life with courage, endured hardships with resilience, and emerged stronger, proving that success is not merely a destination but a journey of perseverance and growth.

*"The greater the obstacle, the more glory in overcoming it."
– Molière*

Every setback is a setup for a comeback. Each moment of struggle shapes us, each failure teaches us, and each success reminds us of the value of unwavering effort.

"Your present circumstances don't determine where you can go; they merely determine where you start."

– Nido Qubein

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“গুরু ব্রহ্মা গুরু বিষ্ণু গুরুদেব মহেশ্বর। গুরু রেব পরং ব্রহ্ম তস্মৈ শ্রী গুরুবে নমঃ ॥”

"Alone we can do so little; together we can do so much."

– Helen Keller

"Gratitude is not only the greatest of virtues, but the parent of all others."

– Marcus Tullius Cicero

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List of abbreviations

Abbreviations	Description
2D	Two-dimensional
AO	Adaptive Optics
BCP	Beam Coherence-Polarization
BS	Beam Splitter
CA	Circular Aperture
CCD	Charge-Coupled Device
CDMP	Complex Degree of Mutual Polarization
CGH	Computer-Generated Hologram
CMOS	Complementary Metal Oxide Semiconductor
DH	Digital Holography
DMD	Digital Micromirror Device
FOV	Field Of View
FT	Fourier Transform
GG	Ground Glass
GS	Gerchberg-Saxton

GSP	Generalized Stokes Parameter
HBT	Hanbury Brown-Twiss
He-Ne	Helium - Neon
HGB	Hollow Gaussian Beam
HIO	Hybrid Input-Output
HWP	Half-Wave Plate
IFT	Inverse Fourier Transform
KK	Kramers-Kronig
L	Lens
LCP	Left-Circularly Polarized
LCVR	Liquid Crystal Variable Retarder
LP	Linear Polarizer
M	Mirror
MDOP	Multi-scale Degree Of Polarization
MO	Microscopic Objective
NLOS	Non-Line-Of-Sight
NSP	Normalized Stokes Parameter
OPC	Optical Phase Conjugation

P	Pinhole
PA	Pinhole Aperture
PBS	Polarization Beam Splitter
PC	Personal Computer
PDF	Probability Density Function
QWP	Quarter-Wave Plate
RCP	Right-Circularly Polarized
RGG	Rotating Ground Glass
SDOP	Spatial Degree Of Polarization
SLM	Spatial Light Modulator
SOP	State Of Polarization
SP	Stokes Parameter
TC	Topological Charge
TIE	Transport of Intensity Equation
TM	Transmission Matrix
vCZ	van-Cittert Zernike
vMF	von Mises-Fisher
WFS	Wavefront Shaping

