The Imaging X-ray Polarimetry Explorer (IXPE): a new window for Astrophysics

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Physics and Astronomy- PhD Studnet - Cycle 39th

PhD retreat at the Gran Sasso Laboratories

17-21 Februray ,2025

IXPE
Imaging
X-Ray
Polarimetry
Explorer

INTRODUCTION
Background

SABA IMTIAZ

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Academic Qualification:

Degree	Year	Board/University
Master	2018-2020	University of the Punjab
Bachelors	2014-2018	University of the Punjab
Intermediate	2012-2014	*BISE-Lahore*
Matriculation	2010-2012	*BISE-Rawalpindi*

Research Area

- Synthesis and Characterization of Materials
- Thesis Entitled as: Effect of Molarity on Optical Dielectric and Structural Properties of Aluminum Oxide Thin Films by Sol Gel Spin Coating Method.

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INTRODUCTION
Current Position & IXPE

- **PHD Student**: University of Padua
- **Research Scholar**: National Institute for Astrophysics (INAF), Rome
- **Research Group Head**: Dr Paolo Soffitta
- **Supervisor** : Dr Fabio Muleri

Imaging X-ray Polarimetry Explorer(IXPE):

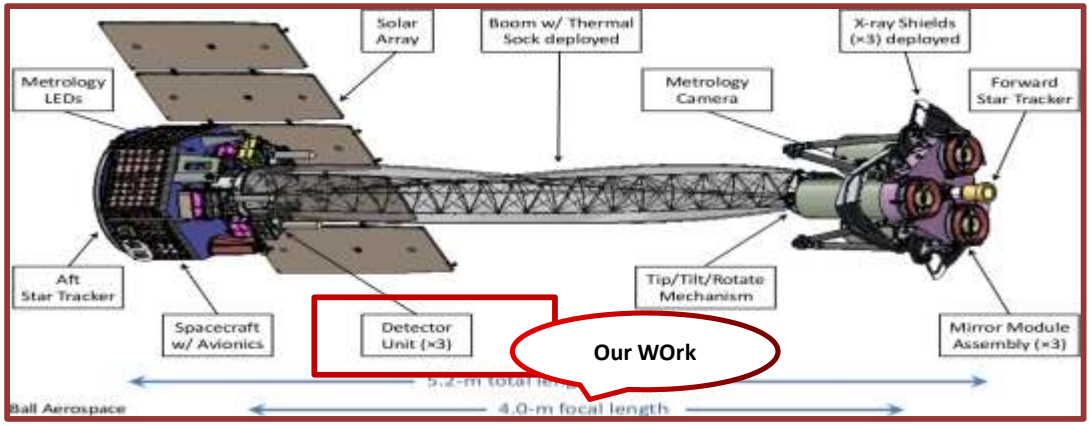
- IXPE will be a pathfinder mission opening a new window on the x-ray sky by ena-bling polarimetry measurements on essentially all classes of the brightest cosmic x-ray sources.

Goal of PHD Project:

- Expanding X-rays Polarimetry Capabilities beyond Imaging X-ray Polarimetry Explorer (IXPE).

Why We do Polarimety?

By Polarimetry we understand the emission mechnisms of and geometry of high energy astrophysical sources like neutron stars, black holes and supernova remnants. By measuring the polarization of x rays, IXPE provides insight to magnetic field structures and particle acceleration processes in these extreme



Deployed View of IXPE

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PHD Project

Current Work

- **Enhancements with TimePix3**

(i) Negligible dead time.

(ii) Simultaneous time and energy per pixel.

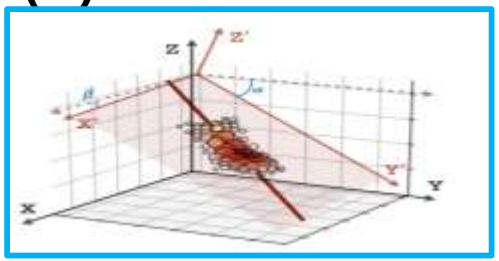
- **Advancing with GridPix Technology**

(i) Unlike GPDs,GridPix offers, precise 3D reconstruction of electron tracks, enhancing polarization measurement accuracy.

(ii) Achieve larger modulation, improving sensitivity across a wider energy range (2-8 & 6-35 keV).

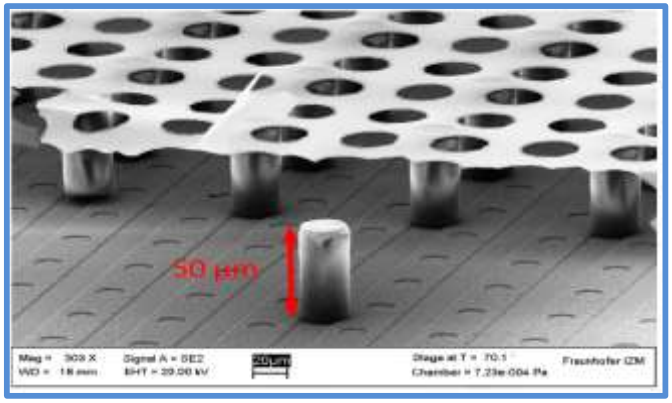
(ii) Improve energy resolution

(iv) Increase effective area

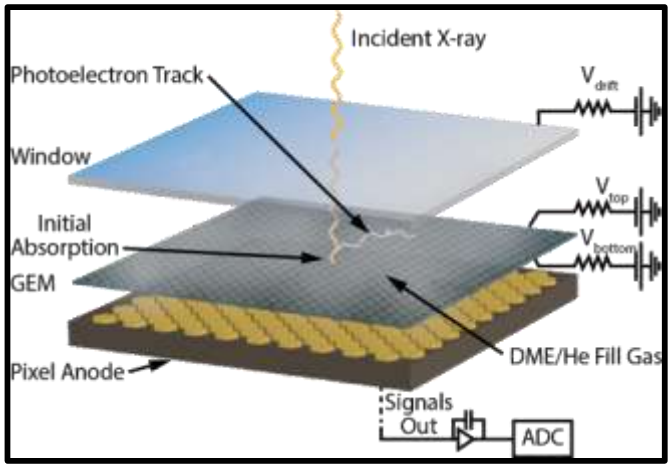


3D track of Photo-electron

TimePix3



Gridpix Detector



Gas Pixel Detector (GPD)

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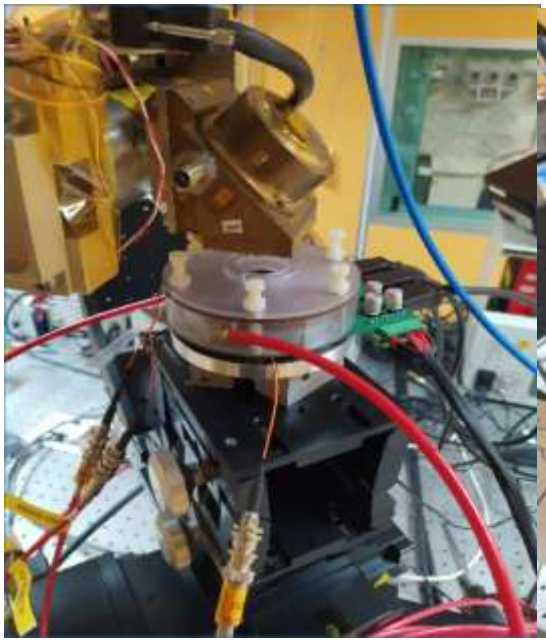
PHD Project
GridPix Analysis

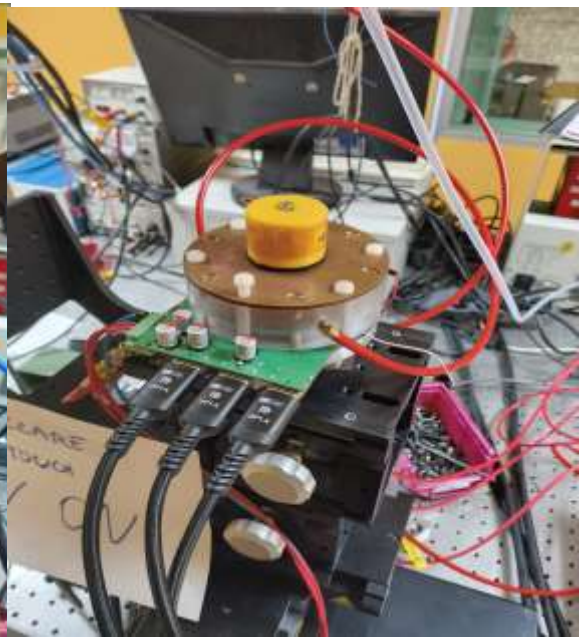
Experiment Setup:

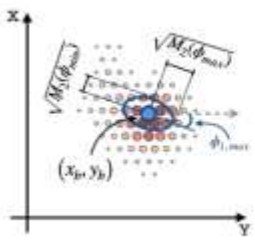
A proto-type of gridpix detector was tested at the x-ray polarization calibration facility at IAPS-INAF.

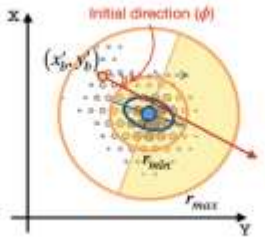
- gas mixture: Ar:DME (80:20)
- thickness: 2cm
- Abs gap : 2cm
- Pressure: 1.05 bar

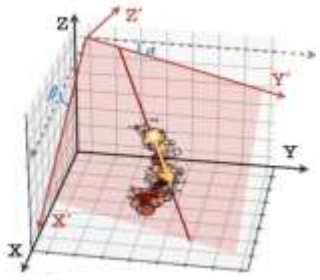
X-ray Source	Energy Value
Fe-55	5.89 KeV
Rh-795uA 4.0kV	2.7 KeV
Mo-800uA-10kV	8.7 KeV
Mo-800uA-10kV	17.4 KeV











1.Monte Carlo Simulation (GEANT4)
2. Data analysis

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CONCLUSION:

We anticipate higher modulation factor and energy resolutions and the data analysis is under progress.

With new advancement: X-ray polarimetry is coming back!

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Thank you for the attention and stay safe!

Prospects for IXPE and eXTP polarimetric archaeology of the reflection nebulae in the Galactic center

L. Di Gesu, R. Ferazzoli et al. A&A, 643, A52 (2020)

In-flight calibration system of Imaging X-ray Polarimetry Explorer

R. Ferazzoli et al., JATIS, 6(4), 048002 (2020)

A Study of background for IXPE

F. Xie, R. Ferrazzoli et al., Astroparticle Physics 128 (2021)