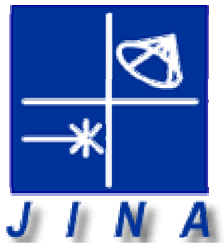
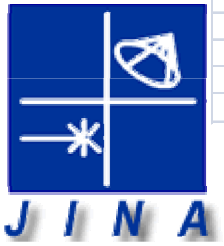
PIXE PAN 2008
Introduction



Schedule

Week 1: Teachers					
	Mon	**Tue**	**Wed**	**Thur**	**Fri**
	6/16/2008	6/17/2008	6/18/2008	6/19/2008	6/20/2008
9:00	Snacks/Welcome Intro (Mary DeWitt) JHS Attrium	PIXE INTRO	Lab 1/2 Intro	Lab 3/4 Intro	Lab 5 Intro
9:30	Jordan Intro and Tour	PIXE	Lab 1/2	Lab 3 /4	Lab 5 Lab Review/Makeup
10:00					
11:00	Rad Safety				
12:00	Lunch	Lunch	Lunch Seminar	Lunch	Lunch
13:00			Jay LaVerne	Lab 4/3 Intro	Introduction to Nuclear Physics
13:30	NSL Intro + Tour		Lab 2/1 Intro		Tony Hyder (NSH 184)
14:00	(Ed Stech)	PIXE	Lab 2/1	Lab 4/3 Intro	Review/ Plan
15:00	PIXE applications talk				for Student Week
16:00	NSL Conference Rm				
16:30	(Larry Lamm)	Recap/Q&A	Recap/Q&A	Recap/Q&A	
17:00	Recap/Q&A				
Week 2: Teachers and Students					
	6/23/2008	6/24/2008	6/25/2008	6/26/2008	6/27/2008
9:00	Snacks/Welcome Intro (Mary DeWitt) JHS Attrium	Lab 1 Intro	Lab 3 Intro	Lab 5 Intro	PIXE Applications (Lamm) (NSL)
9:30	Jordan Intro and Tour	Lab 1	Lab 3	Lab 5	Analysis Presentation Prep
10:00					
11:00	Rad Safety				
12:00	Lunch	Lunch	Lunch	Lunch - NSH 202	Lunch
13:00		Lab2 Intro	Lab 4 Intro	(Astro: Peter Garnavich)	Student Presentations
13:30	NSL Intro + Tour				184 NSH
14:00	(Ed Stech)	Lab 2	Lab 4	Analysis	Each group of students @ 15 minutes each
14:30	Introduction to JINA			Presentation Preparation	
15:00	Science (NSL Conf)				Tour of the Labs
16:00	(Philippe Collon)			Make Up Lab	
16:30	Recap/Q&A	Recap/Q&A	Recap/Q&A		for parents by students.
17:00					



General Comments

- Emphasis is not on getting the correct answer, but rather understanding the experimental methods used and physical concepts involved.
- All participants are encouraged to ask questions.
- Work as a group, help each other understand.

Photons

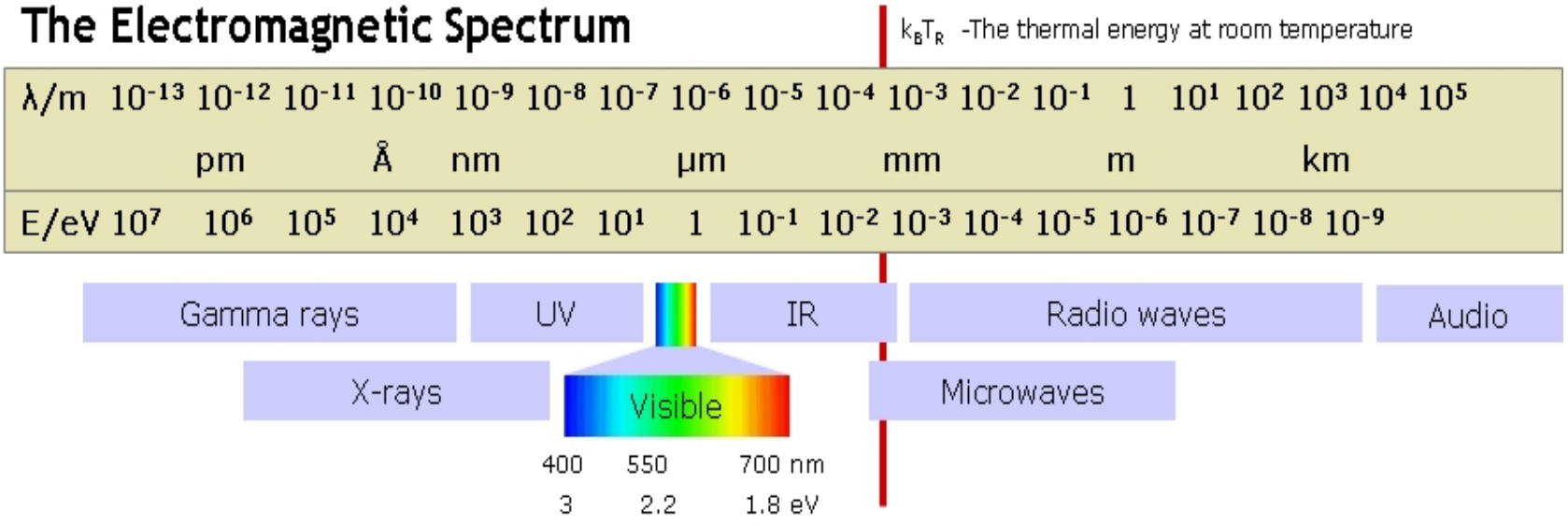
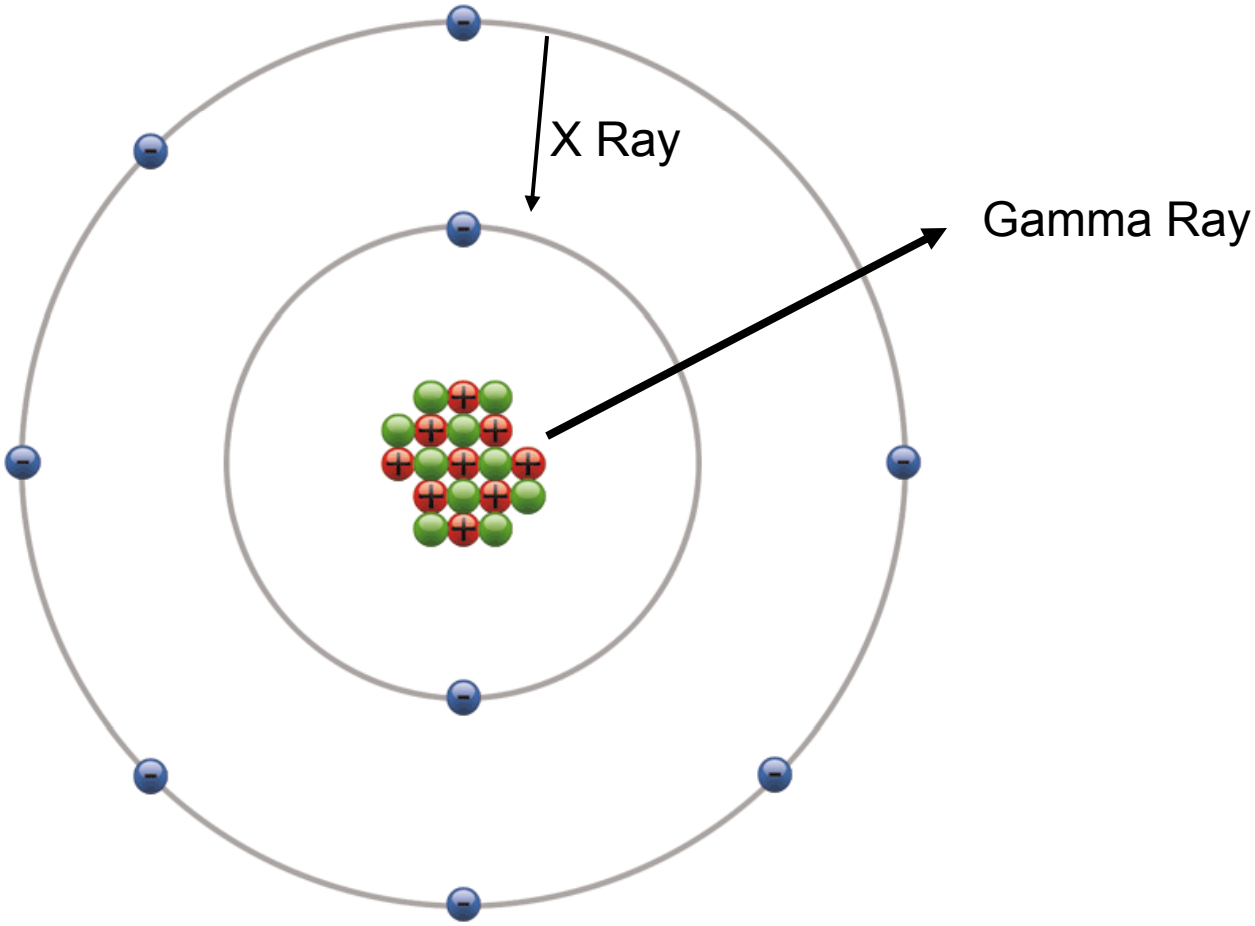


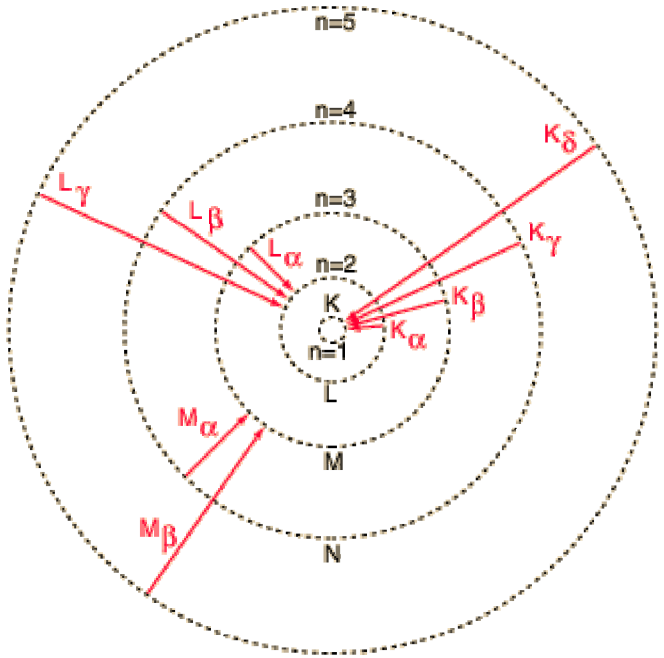
*Illustration from Opensource Handbook of Nanoscience and Nanoechnology

X and Gamma Ray Origins

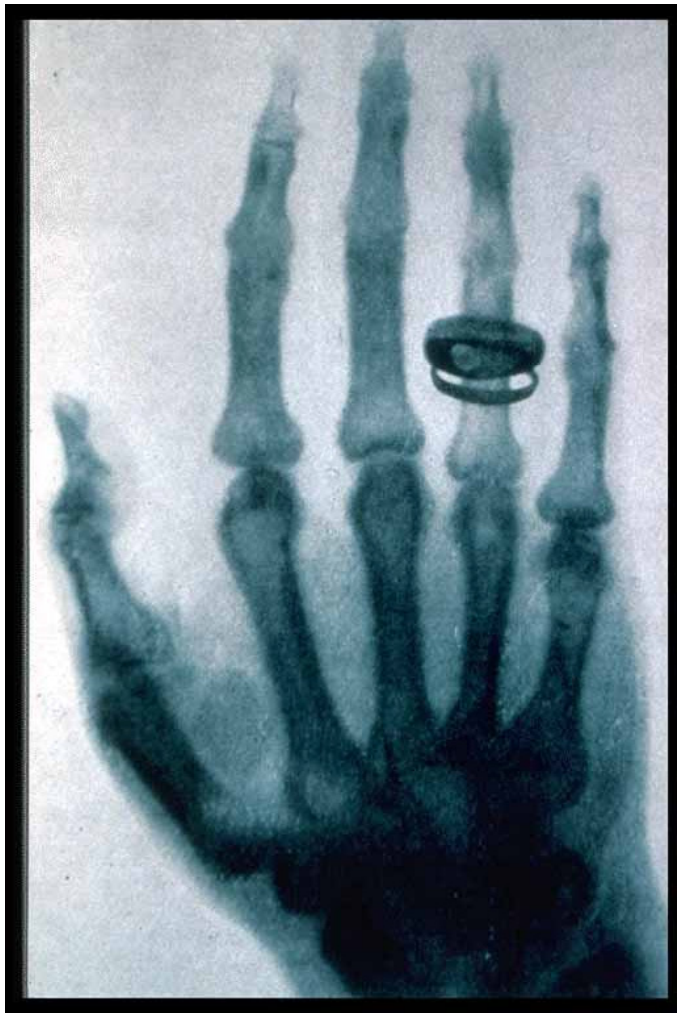


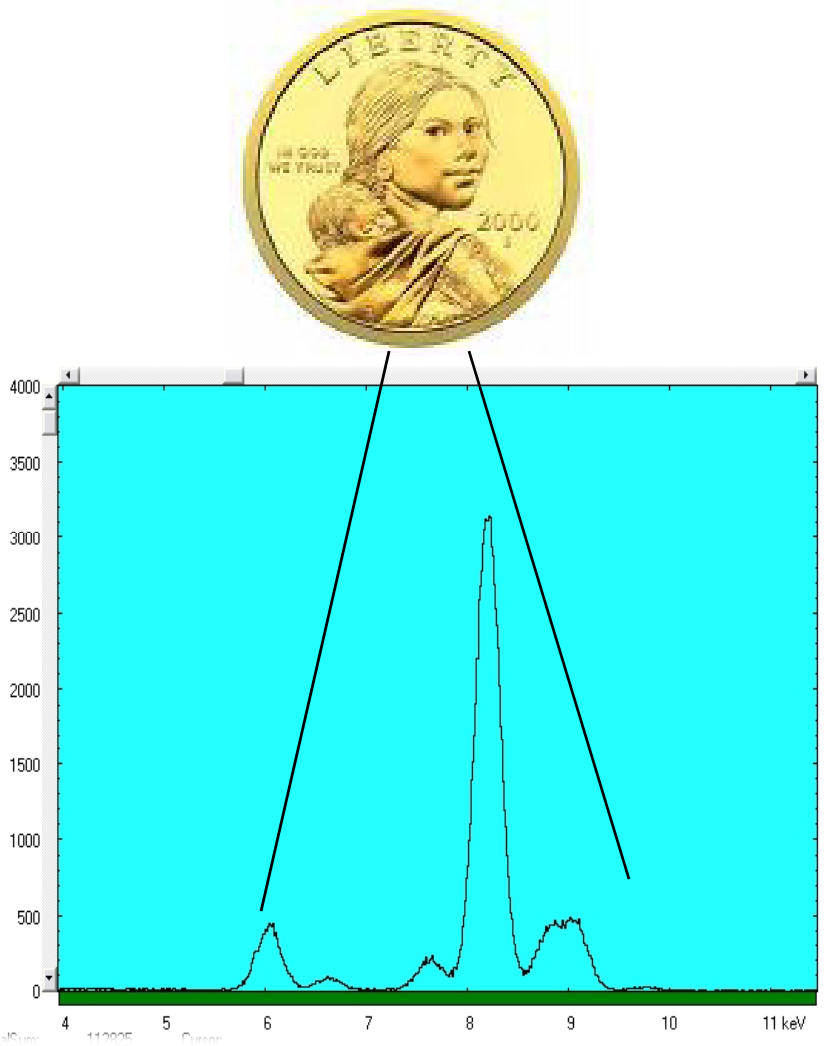
Some X Ray Nomenclature

- The orbits (or shells) are most often referred to by a letter rather than the principle quantum number (n=1 is the K shell, n=2 is the L shell, etc.)
- Transitions are labeled K_α, K_β, etc. as shown.



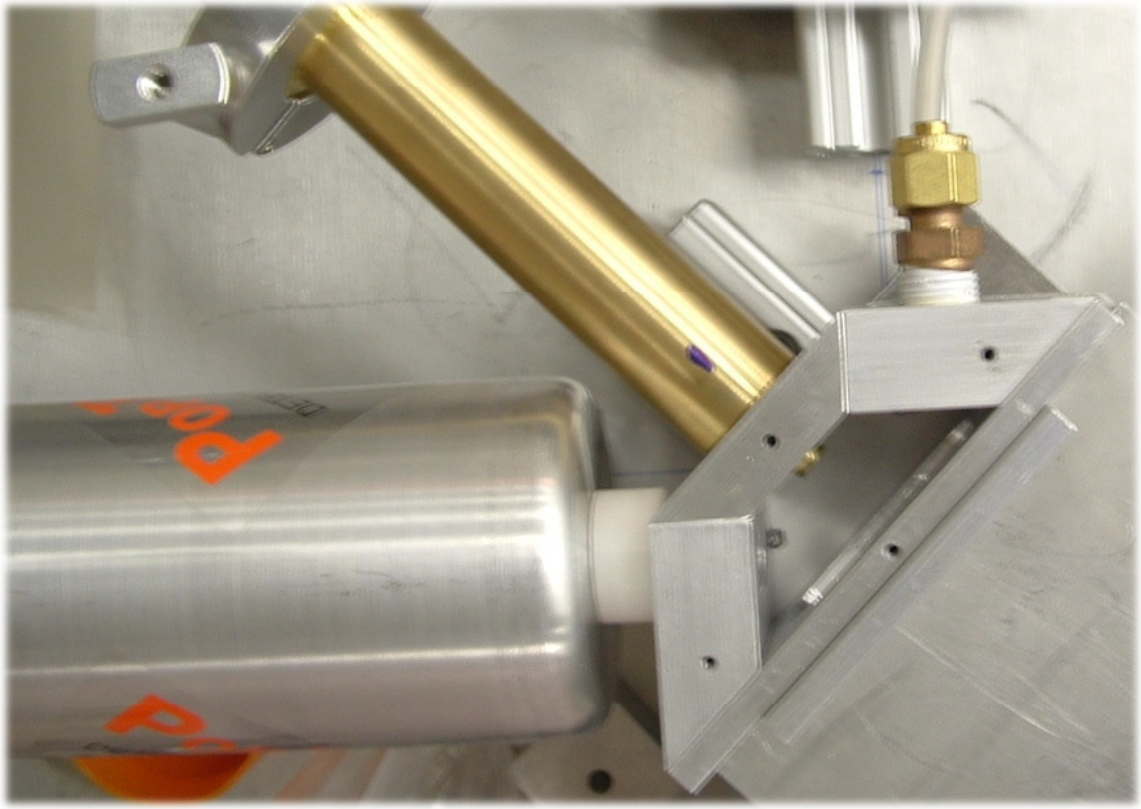
Information from X-rays





JINA

Experiment I PIXE



- Use a proton beam from the NSL's FN accelerator to excite a variety of targets
- Use the characteristic X Ray Energies to identify the elemental composition of the materials.
- Use the small beamspot (1-2mm diameter) to investigate spatial distributions.

Experiment II XRF

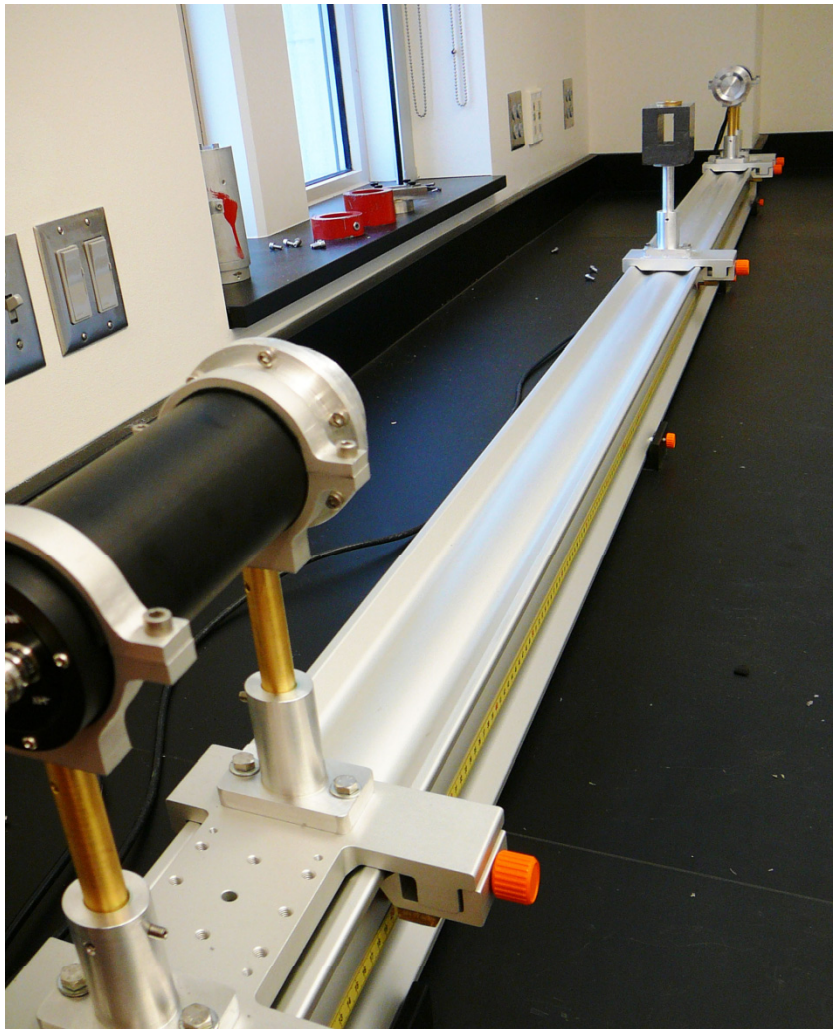
- X Ray Fluorescence – Use an X-Ray source to excite atoms in the target instead of the proton beam.
- Measure a variety of objects.
- Test Moseley's Law relating X-ray Energy to atomic number.

Experiment III Speed of Light

•Use Electronic modules as the stopwatch to time how long it takes a 511 keV photon to travel a distance of a meter or so.

•Use this information and a simple analysis to measure directly the speed of light.

•Photon source is the positron-electron annihilation from ^{22}Na.



JINA

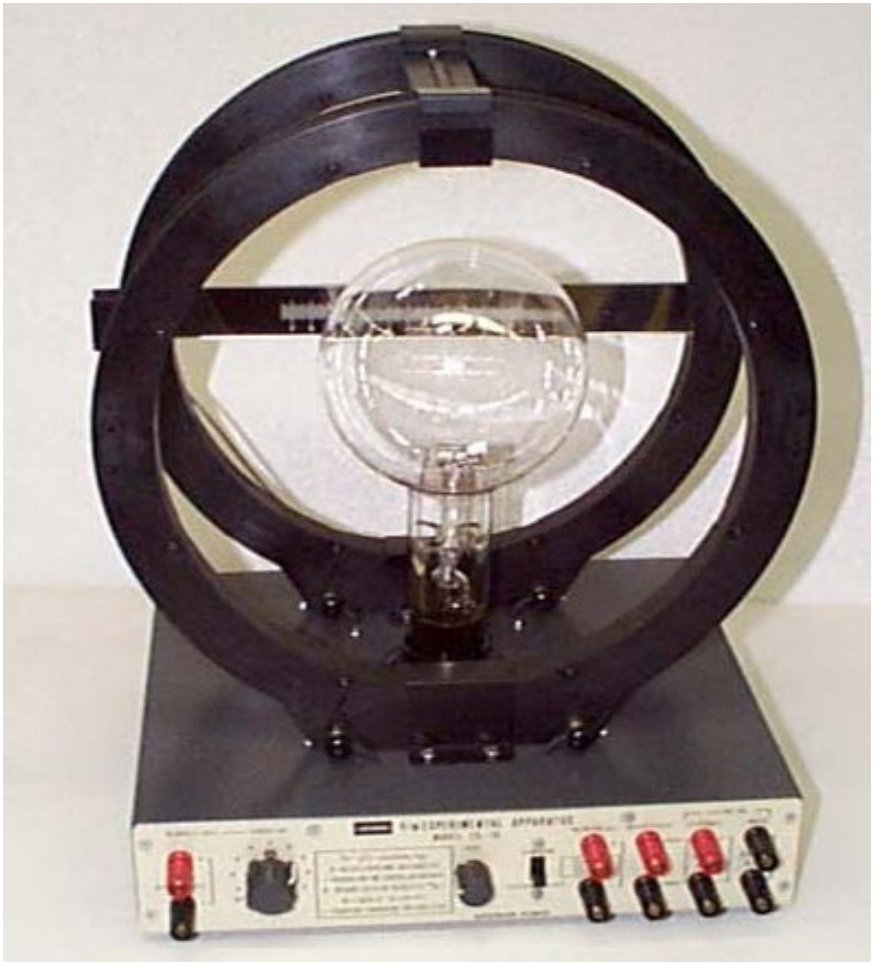
The Joint Institute for Nuclear Astrophysics
www.JINAweb.org

Experiment IV Compton Effect

•An example of the particle nature of light by measuring the change in energy of photons scattered by the electrons of a solid object through different angles.

Experiment V Optics

- A set of various labs with an emphasis on optical light.
- Look at wave nature of light through diffraction and interference.
- Also, see the effect of magnetic and electric fields on the motion of an electron
- Determine the electron's charge to mass ratio



JINA