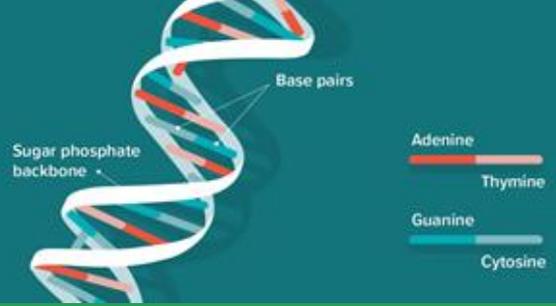


C23-Use of X-Ray in Crystallography



Objectives

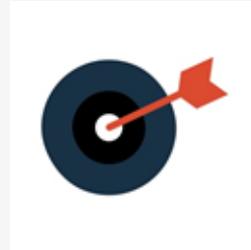
What is Crystallography?

History of Crystallography

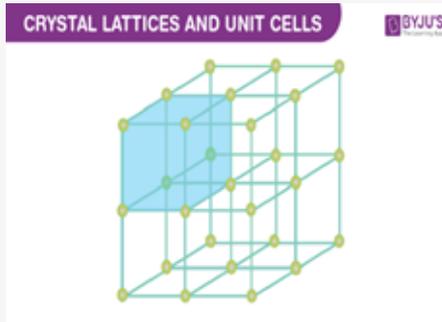
How X-Rays are used in Crystallography

Uses of Crystallography

Crystallography and the X-Ray Circuit

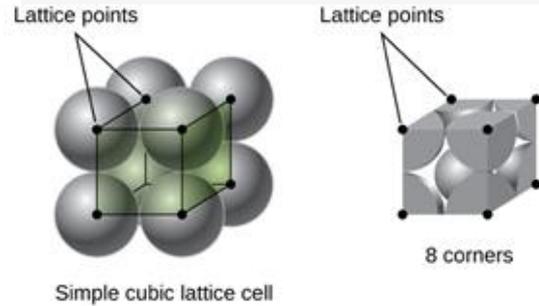


What is Crystallography?



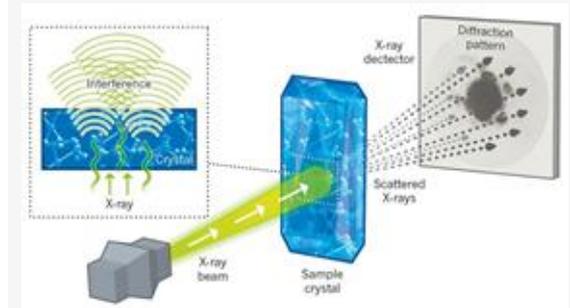
Simple Definition

Study of Atomic Arrangement within a Material



Expanded Definition

“A branch of science that deals with discerning the arrangement and bonding of atoms in crystalline solids and with the geometric structure of crystal lattices” (Britannica, 2018)



How?

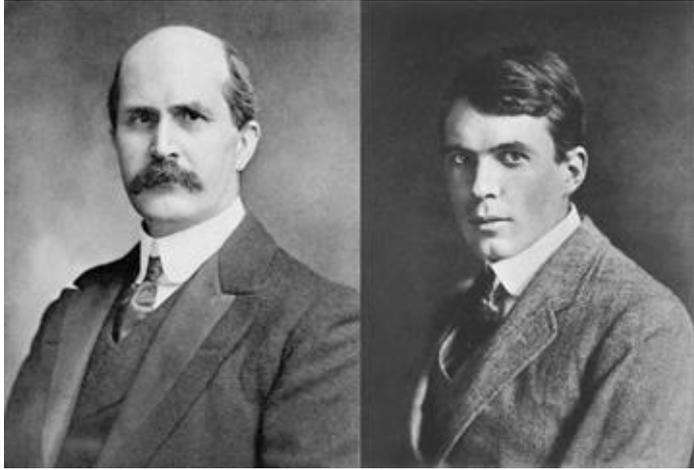
“Determine arrangement by analyzing how X-rays **diffract*** when they interact with a **crystal****”-(IOP, 2015)

History of Crystallography

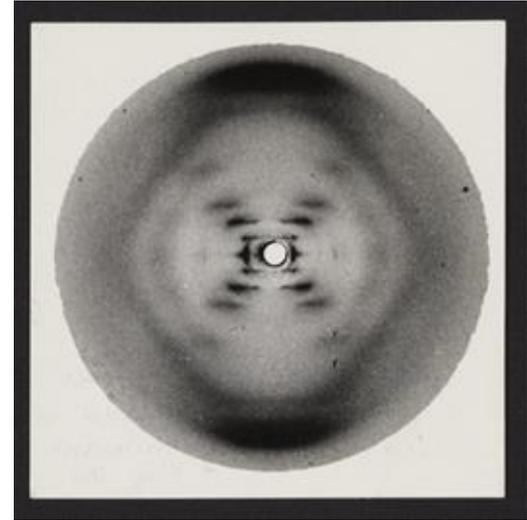
- **Philosophers in ancient greek studied crystal geometry**
- **Democritus proposed the early theories of atomism**
- **Plato and Aristotle theorized about crystals geometric shape**



History of Crystallography pt 2



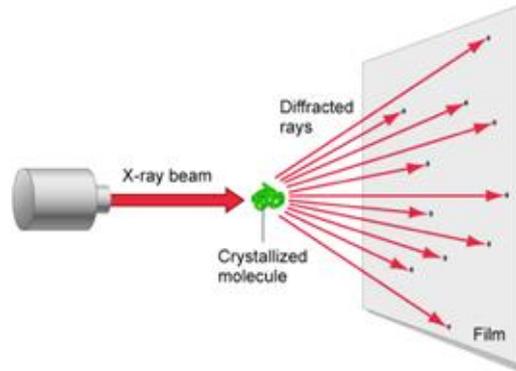
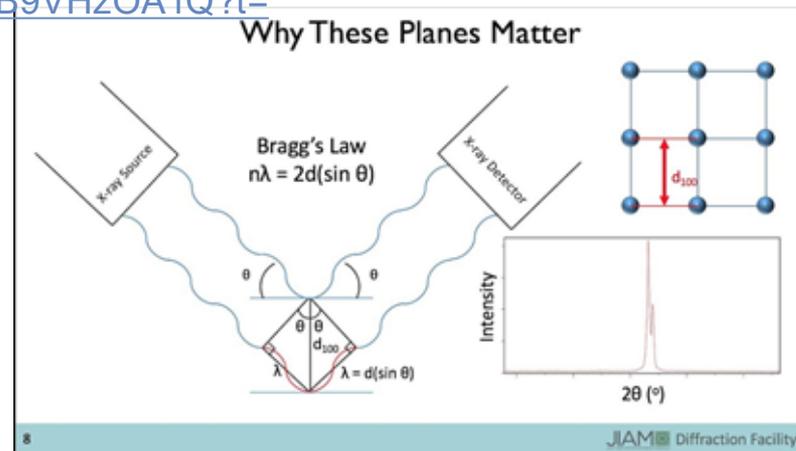
- Max Von Laue theorized diffraction after the discovery of X-Ray
- Father-Son duo, William Henry/William Lawrence Bragg, confirmed the theory later stating “X-rays could be used to determine the positions of atoms within a crystal accurately” (IOP, 2015)



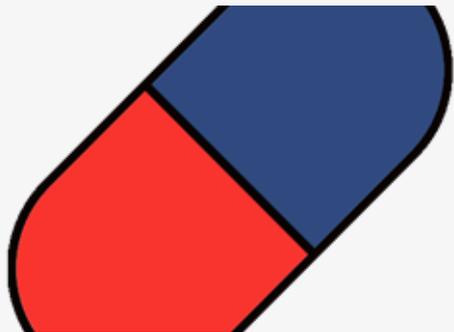
- Structure of DNA was discovered in 1953 by Rosalind Franklin and Maurice Wilkins
- “Franklin took the infamous diffraction image “Photo 51”” (AJR, 2010)

How X-Rays are Used in Crystallography

- X-Rays are directed at crystal sample
- Diffract due to atomic arrangement
- “Need a good, reliable sample” (PMC 2020).
- **Goniometer***
- **Bragg's Law****



Uses of Crystallography



Medicine

- Determine Drug Design
- How they interact with system
- Binding Site



Engineering

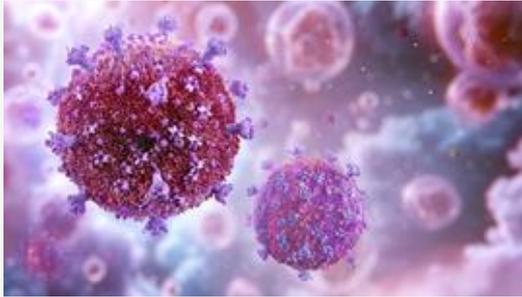
- Used to analyze materials
- Select most optimal material
- Determines a materials strength, conductivity, stability



Forensics

- Provides reliable evidence with small samples
- Evidence can be used to solve cases

Examples



Medicine

- Countered the HIV virus
- Led to discovery of Insulin
- Critical in Cancer research



Engineering

- Used to discover “microcracks and load cracks” (Malvern Panalytical, 2021)
- Fixed many issues dealing with airplanes



Forensics

- Able to identify various materials, such as gunshot residue, soil residue, and broken objects
- “Smears, minute contact traces, small sample quantities, or tiny sample areas can be successfully analyzed as well as large quantities of materials” (Kugler, 2003).

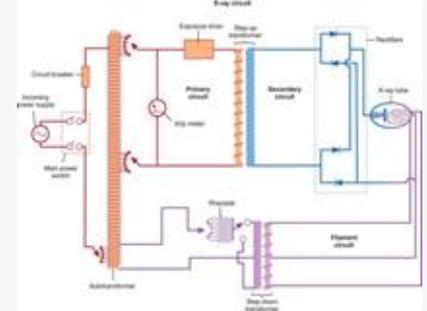
Crystallography and Electronics

- Play a role in formation of phones and computers
- Analyze materials for battery optimization
- Can determine which materials conduct electricity best
- Important role in semiconductor materials



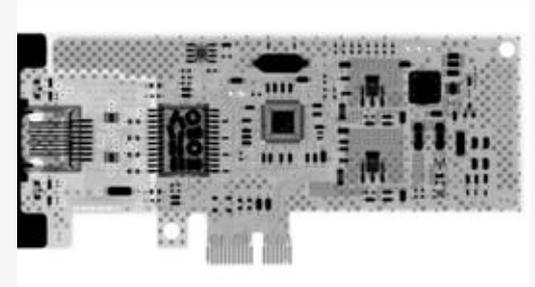
Crystallography and X-Ray Circuit

- **Semiconductors are a vital part of X-ray Circuit**



- **Played a crucial role in finding the right semiconductor material for the X-Ray tube**

- **Materials such as Silicon, Gallium Arsenide and Silicon Carbide**



Conclusion

- **Field is always evolving**
- **Uses are numerous**
- **Thank you for bearing with me**



Sources

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