

## Introduction

Most rechargeable batteries have intercalation materials which is used for inserting ions into the battery to be reused again. But overtime as the battery is used the reinserted ions cause the intercalation material to degrade making it useless which is a issue for modern batteries.

## Objective & Impact of Professor's Research

Professor Balakrishna's research goal is to promote the use of intercalation materials, improve the material's properties and improving the lifespan. By researching the behavior, process of intercalation and other flaws. This research can be used to enhance the material's structure and which can improve the lifespan of the material. These research results can provide evidence to make intercalation materials be used more.

## Acknowledgements

I would Professor Ananya Renuka Balakrishna, my SHINE mentor Delin Zhang and my family for this amazing experience.

## Skills Learned

During the weeks at SHINE I have learned to model a Crystalline Lattice Structure using a coding program called "Mathematica". I have also learned about different lattice structures and how to identify them, such as "Primitive Cubic" (PC), "Body-Centered Cubic" (BCC), and "Face-Centered Cubic" (FCC).

## How This Relates to Your STEM Coursework

My SHINE experience has greatly impacted my understanding what goes on researching at a college level looks like and has given me a advance skills to read at a college level. I've also learned how to use Mathematica which can help me in my college years.



## Next Steps for You

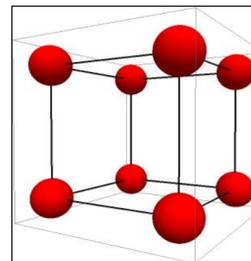
Using my new and improved skills from SHINE I will use them to be more advance in my classes and further future.

## Advice for Future SHINE Students

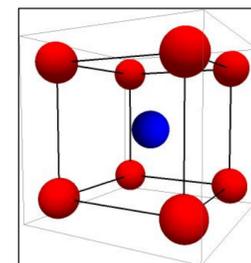
One advice I could say to the future SHINE students is to learn as much as possible in this program because it can help them in the future and prepare them for college.

## Crystal Lattice Structures and Lab Activity

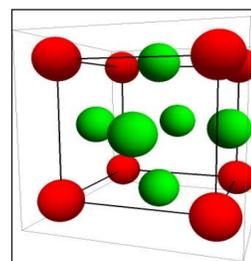
- **Primitive Cubic (PC):** A simple structure with a lattice point on each corner to form a cubic shape.



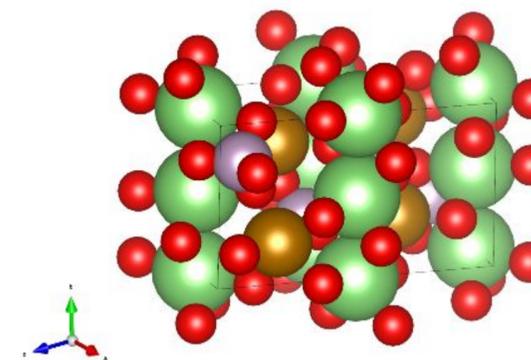
- **Body-Centered Cubic (BCC):** Same lattice structure as a Primitive Cubic, but with one addition point in the middle.



- **Face-Centered Cubic (FCC):** Has points at each corner and, as the name implies, at the each center of the faces has an additional point.



For the last weeks of SHINE my lab mentor gave me a chemical compound formula to visualize through mathematica to show what I have learned.



This is a full model of the compound structure called "LiFePO<sub>4</sub>."

