

Ultraviolet Photoconductivity in Doped LaMnO_3

By Logan Pyle

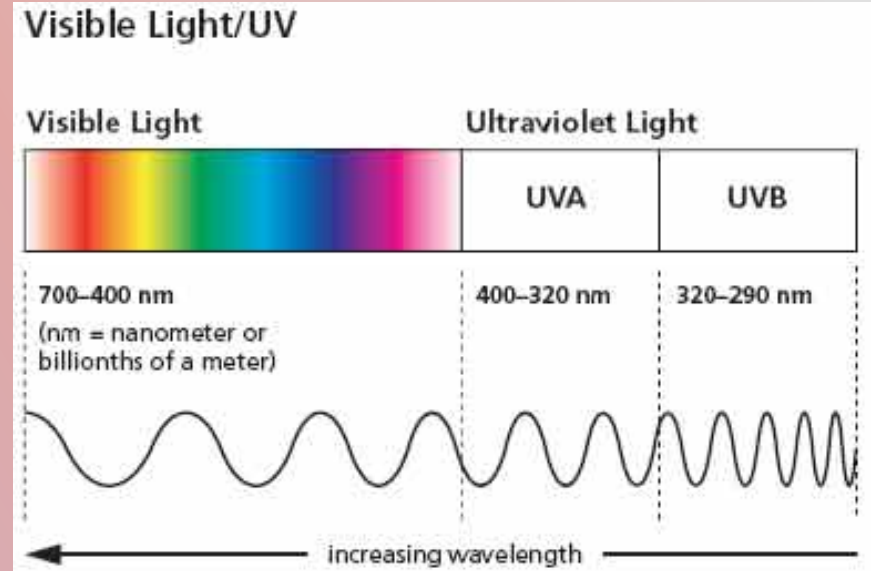
With Help from Mentor Dr. L. L. Henry

Introduction



REU Students

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Current Physics Students

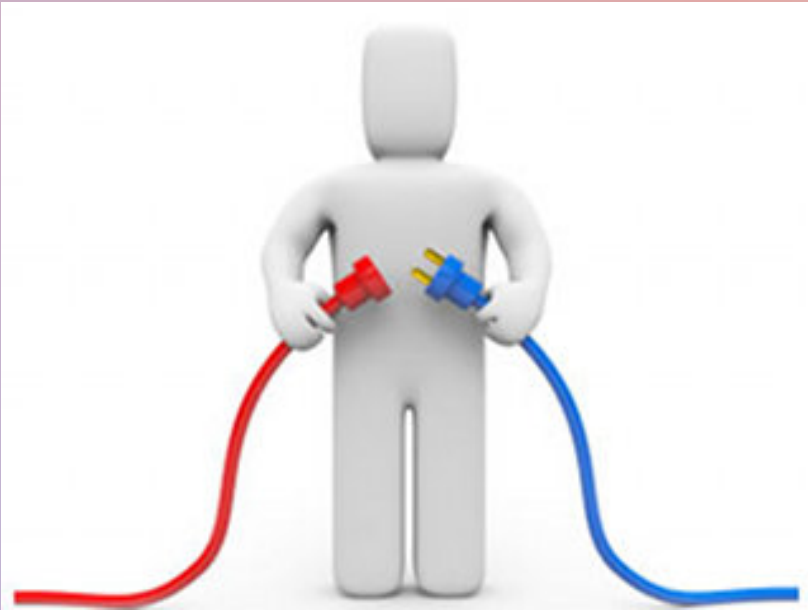
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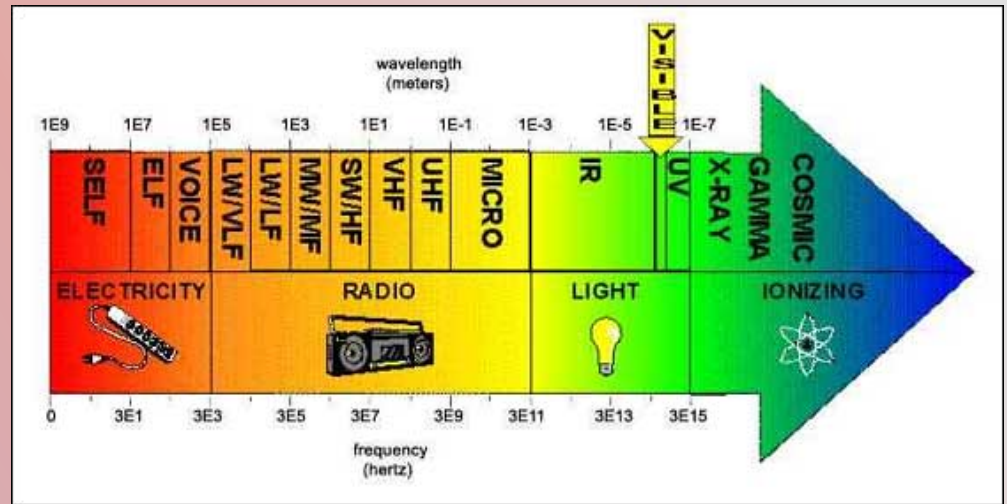
My Task

- Finding the (Potential) Connection.
- Put Together a Huge Outline of Background Information
- Suggest Directions to Continue the Project



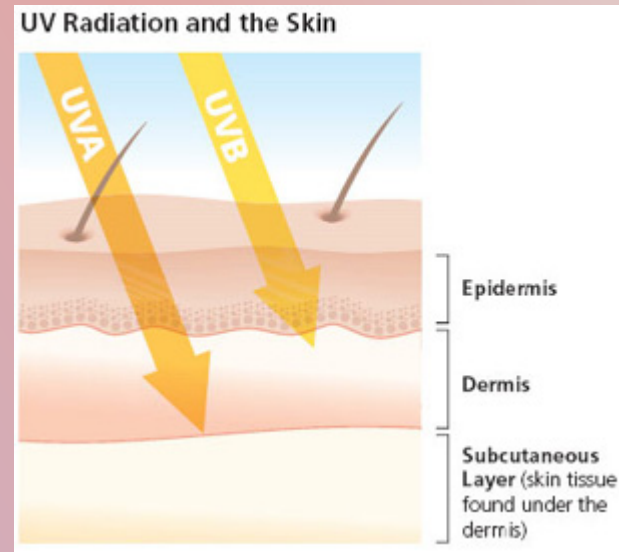
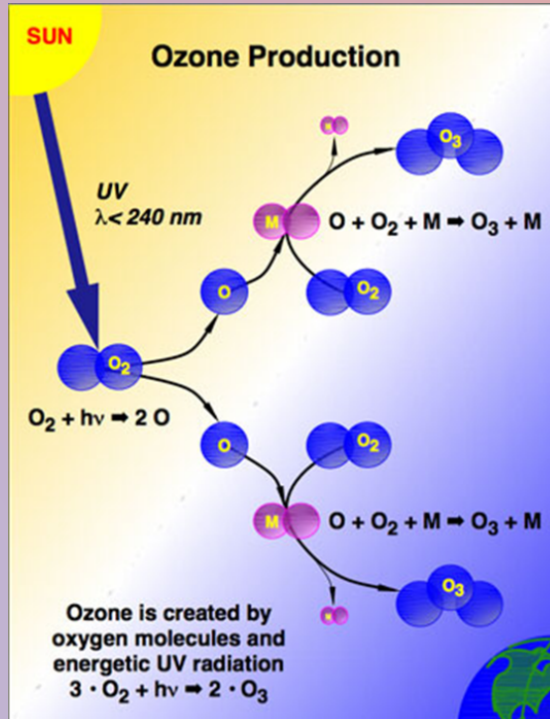
UVR and Effects

- 5 separate distinctions: UV-A (320-400nm), UV-B (290-320nm), UV-C (220-290nm), Far UV (190-220nm) and Vacuum UV (40-190nm).
- UVR has many effects. Here are some:
- Produces Ozone
- Sunburn/Melanin
- Degrades Plastic



Ultraviolet Radiation (UVR or UV Light) is part of the electromagnetic spectrum

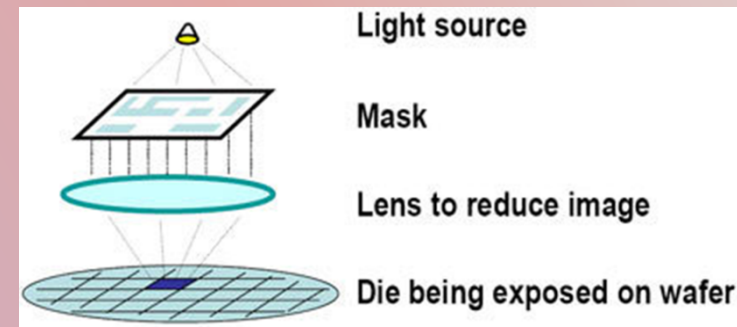
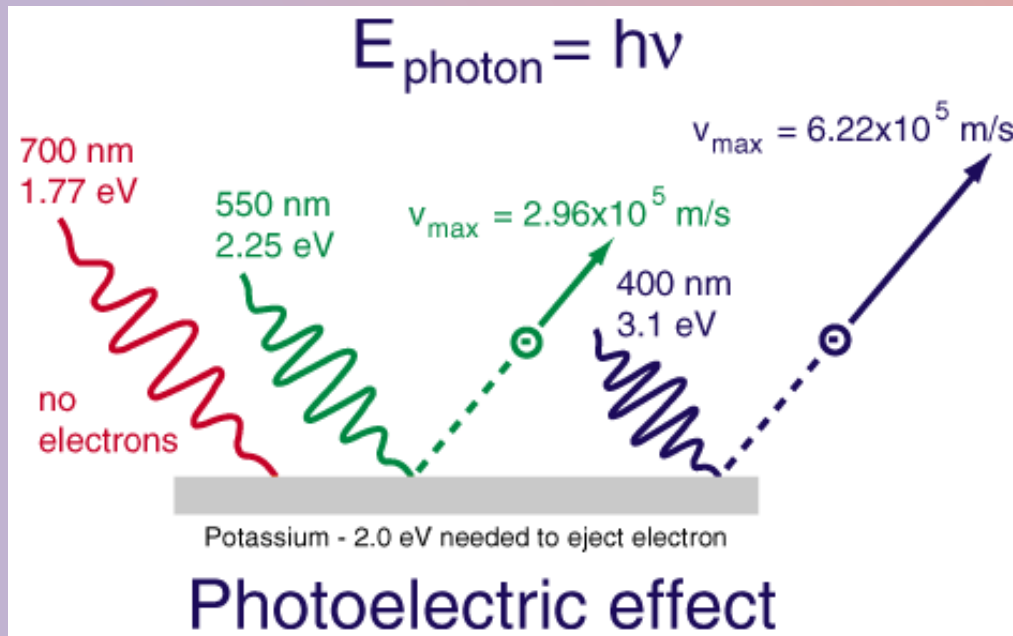
Ozone Production



Effects of UVR on the Skin

UVR Detection and Uses

- Photoelectric Effect
- Detectors
- Black Lights
- Purifying Water/Photolithography



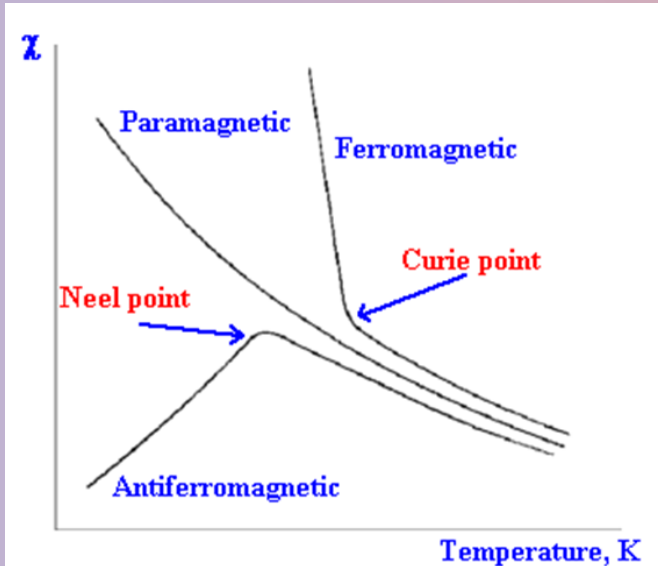
Lanthanum Manganite Series

Lanthanum + Manganese + Oxygen =

Lanthanum Manganite!

- $LaMnO_3$ is a ceramic. Ceramics are hard, brittle and corrosion resistant materials that are commonly semi-conductors.
- **Strontium (Sr)** and **Calcium (Ca)** are two (Alkaline) Rare Earth Metals that are doped with $LaMnO_3$.

Periodic Table of the Elements

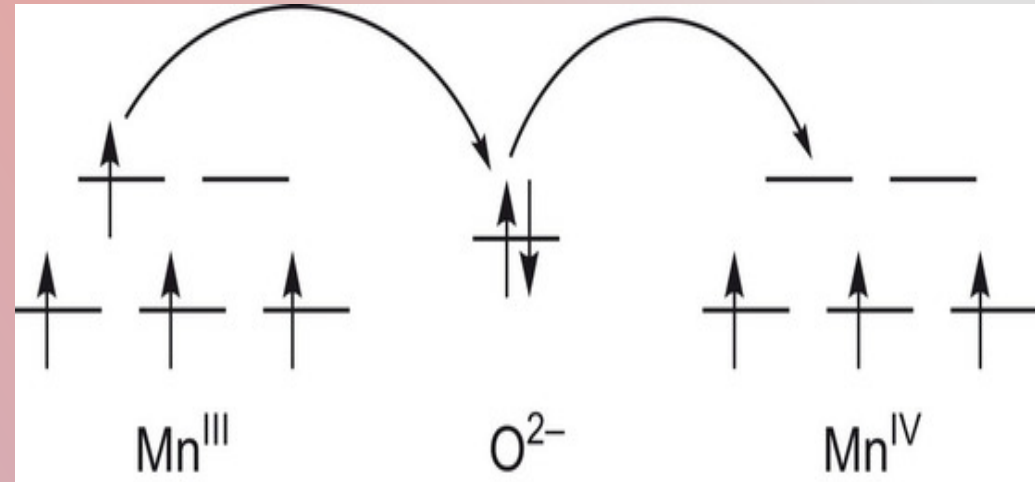


Lanthanum Manganite is frequently found doped in scientific experiments. $LaMnO_3$ is doped with the Rare Earth Metals to increase its magnetic and conductive properties. More info about why on the next slide

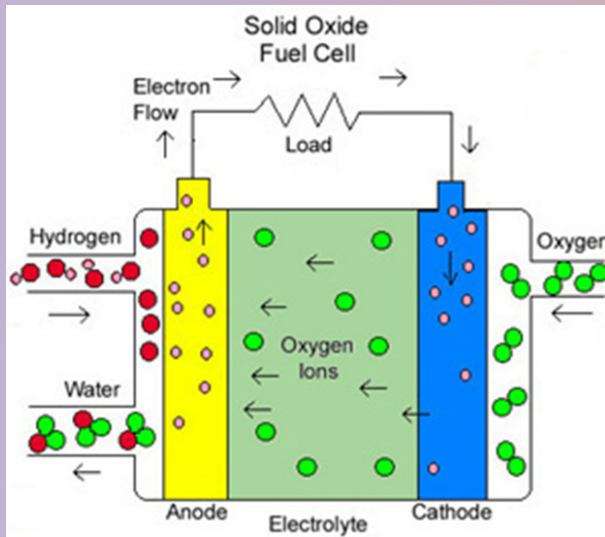
Curie Point/Temperature

Doped Lanthanum Manganite Series

- Doped Lanthanum Manganite has increased magnetic capabilities
- These occur because
 - 1. The Double Exchange Theory
 - 2. The Jahn Teller Distortion



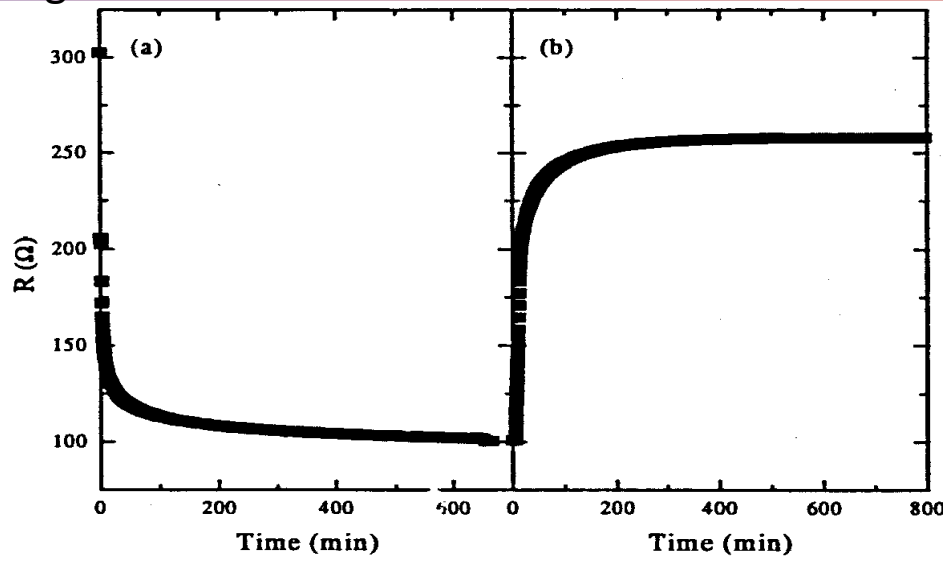
- Lanthanum Strontium/ Calcium Manganite's (LSM and LCM) most common use is being the cathode of fuel cells. LSM is the most common cathode used today.



Connection

- The Two are Connected!

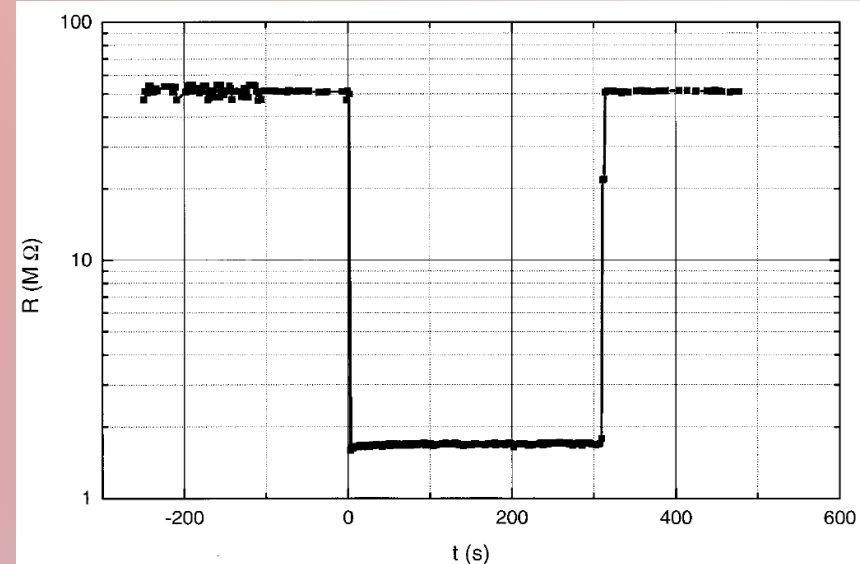
Figure 1



Part (a): The resistance under illumination vs. Time at 95 Kelvin

Part (b): The resistance not under illumination vs. Time at 300 Kelvin

Figure 2

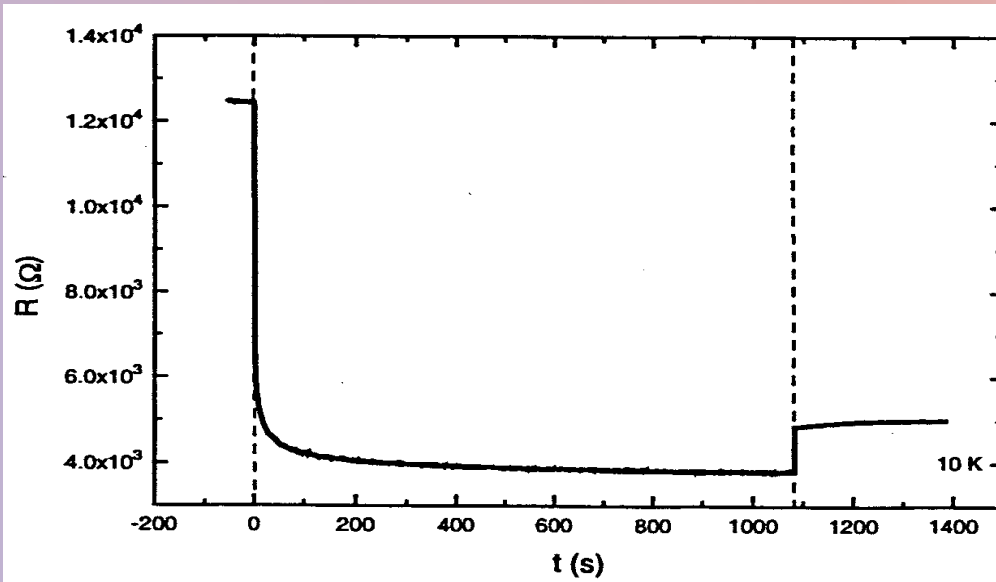


Shows the Resistance under and not under illumination

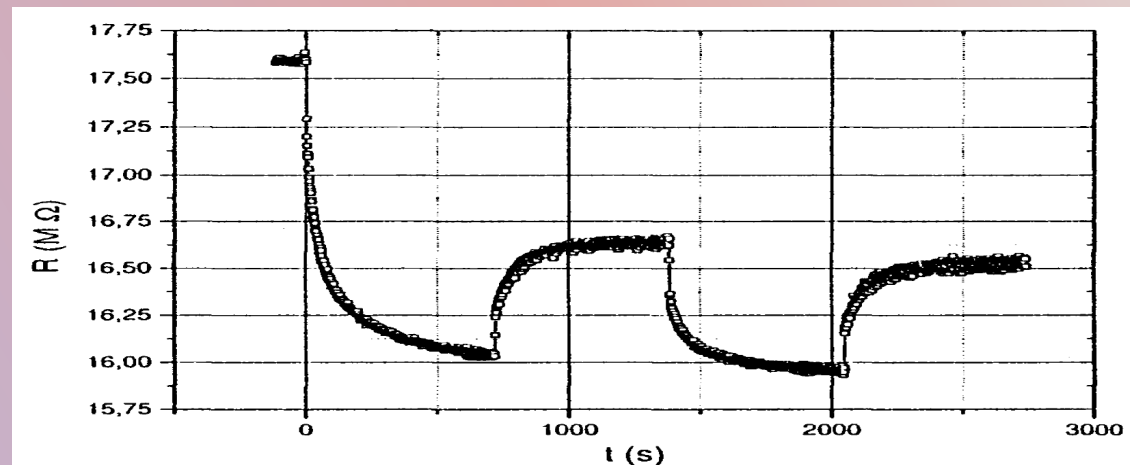
- When exposed to UV light for extended periods of time, the electrical resistance of Oxygen-Deprived Lanthanum Manganite Drops
 - Key: Oxygen Deprived and Doped

Connection #2- PPC

- Each compound below a certain temperature will keep the properties brought on by light. These compounds are showing Persistent Photoinduced Conductive (PPC) properties.

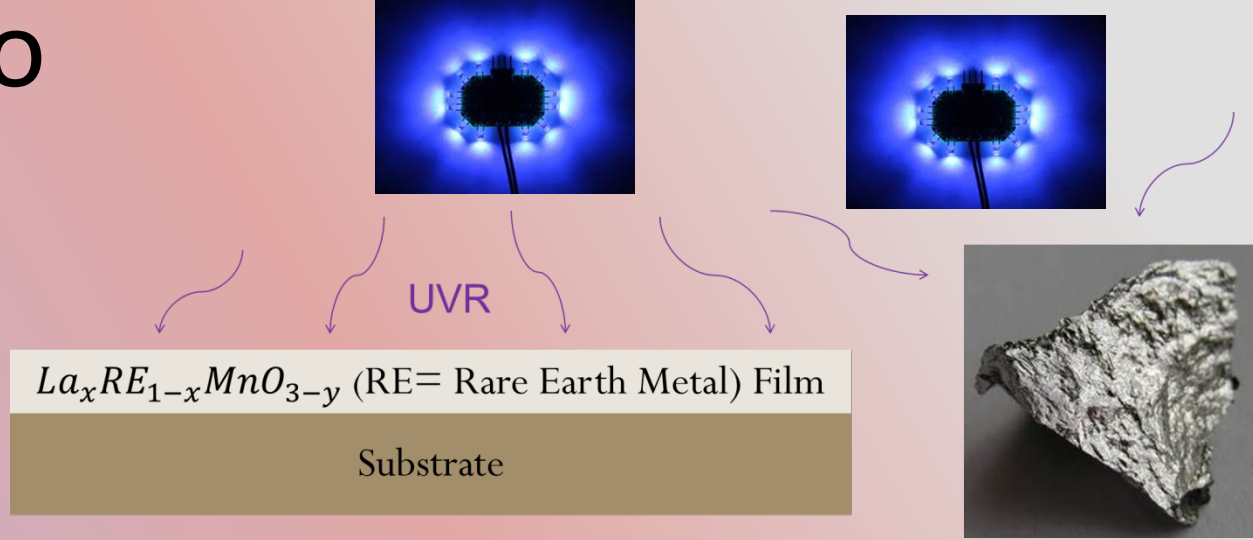


- As you can see in each picture, PPC properties are not exact replicas of properties seen under illumination. However, PPC still show impressive properties.

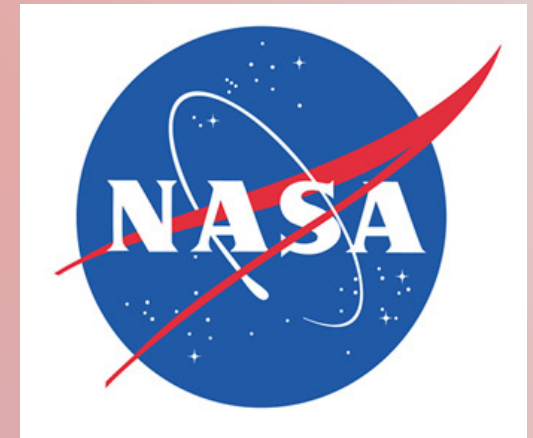


Where to Go Next/ Synthesis Routes

- Dr. Henry Wants to Test Doped Lanthanum Manganite.
 - He wants to test the physical properties
 - He wants to test bulk and thin film samples if possible



- Possible Applications include Solar Energy Technology, Fuel Cell Technology and NASA applications.



Acknowledgements and Sources

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