An Experimental Investigation of Solar Capabilities of the InGaP Photovoltaic Device

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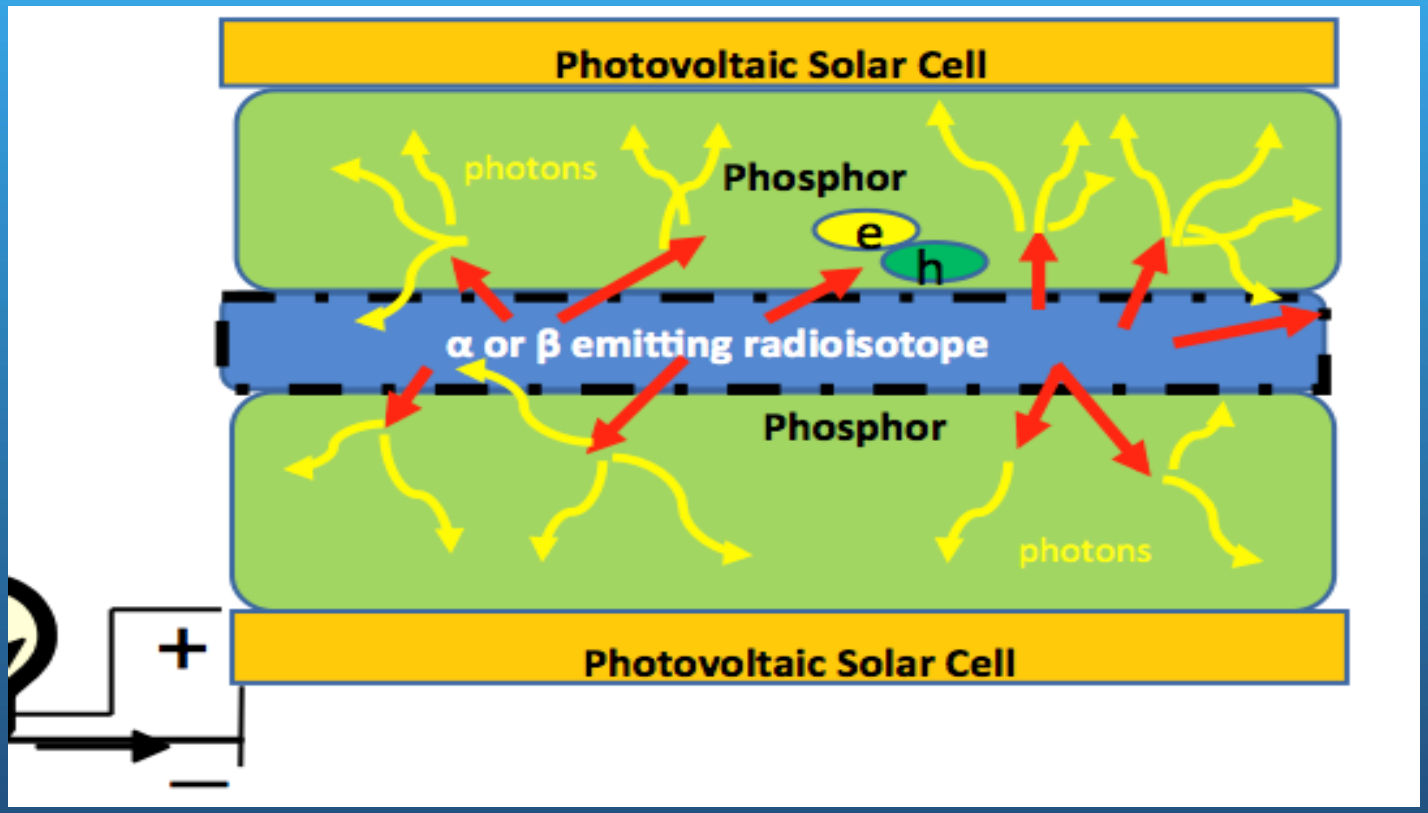
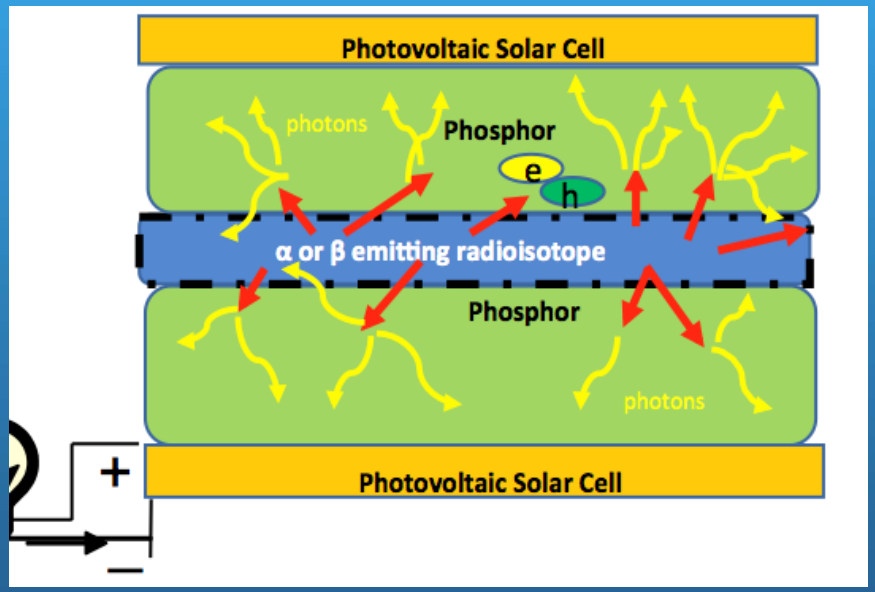
Motivation-Army Ground Sensors

Isotope Battery Component



- We use the phosphor because its interaction with the beta particle generates light emission

Photovoltaic Devices (PVs)



- Photovoltaic devices (a.k.a. photovoltaic cells or PVs) generate electrical power by converting light energy into a flow of electrons
- The specific device used was InGaP

Indium Gallium Phosphide Device (InGaP)

- Specifically designed to be tested and used by the alternative energy team
- Designed to have a low **leakage current**
  - The background loss of current in the photovoltaic process due to structural impurities
  - Natural error within the devices
- InGaP was designed to have a low leakage current for utility in low light illumination

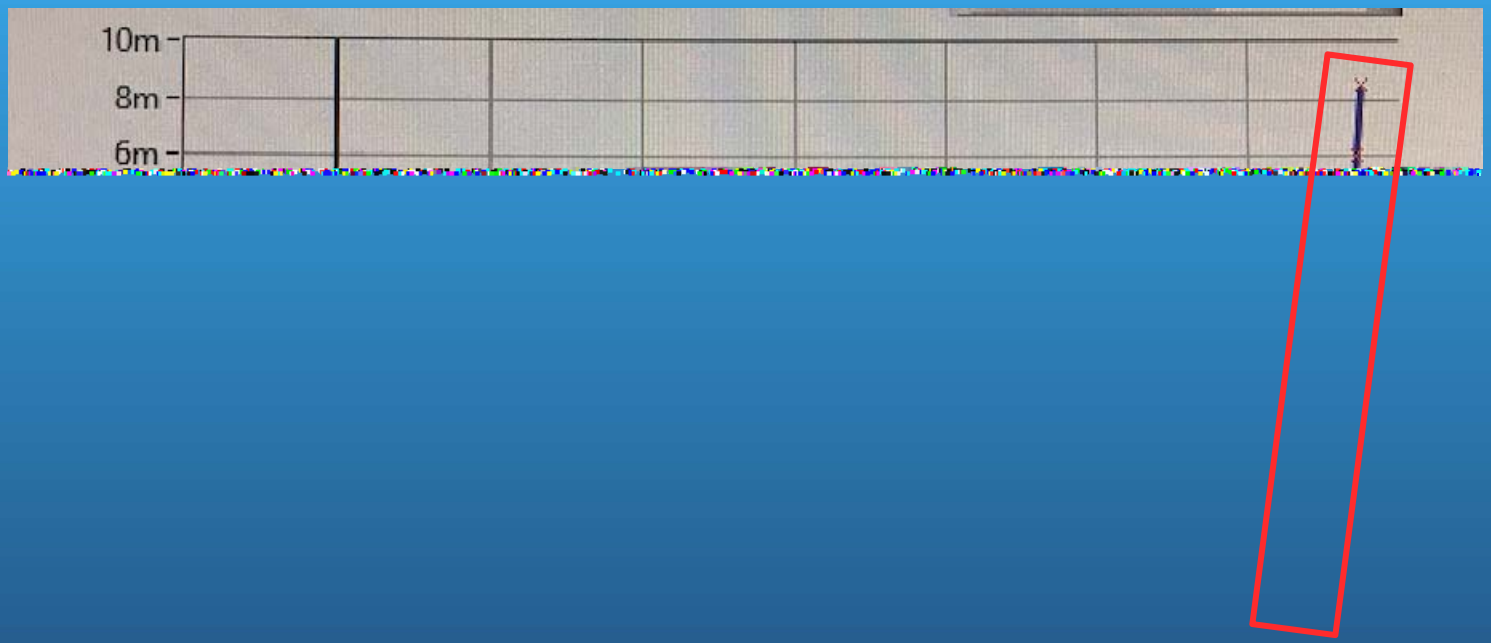
Project Motivation

- The InGaP devices have proven themselves to be able to efficiently convert 100 $\mu W/cm^2$ of monochromatic light (16%)
- This research experiment investigates how the same devices will convert under the full spectrum of solar light
  - Several transmitted wavelengths were also tested using colored filers

Experimental Design

- Calculation conducted to find specific height that simulator should be set to in order to achieve realistic conditions
- Calculated InGaP efficiency under different light conditions
  - Unfiltered
  - tinted
  - red
  - green
  - blue

Results-Data Plot



Efficiency Calculation

- Maximum Power Point:
  - $P_{max} = I_{max} \times V_{@max}$
- Efficiency:
  - $Eff = P_{max} / P_{optical}$

Results-Conversion Efficiencies

Filter	InGaP 1	InGaP 2
No Filter	13.65%	13.95%
Dark Filter	0%	0%
Blue Filter	2.41%	2.42%
Red Filter	3.39%	3.85%
Green Filter	4.39%	4.35%

Conclusions

- The data indicates that the InGaP photovoltaic device is able to convert solar light at an average of 13.8% efficiency
- Colored filter trials ultimately served primarily as justification for the Alternative Energy Team's usage of specific phosphors

Questions?