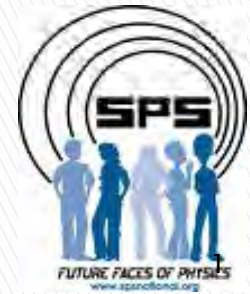


# Search for Hydrogen on the Lunar Surface

AMERICAN  
INSTITUTE  
OF PHYSICS



[i160.photobucket.com/.../shs\\_moonWater-1.jpg](http://i160.photobucket.com/.../shs_moonWater-1.jpg)



**Jose Castellano**  
**7/17/09**



# Implications and Significance of finding Water on the Moon

- ▶ Water on the moon could be used for resources to sustain life
- ▶ Hydrogen could be used for fuel
- ▶ Significantly cheaper and more efficient



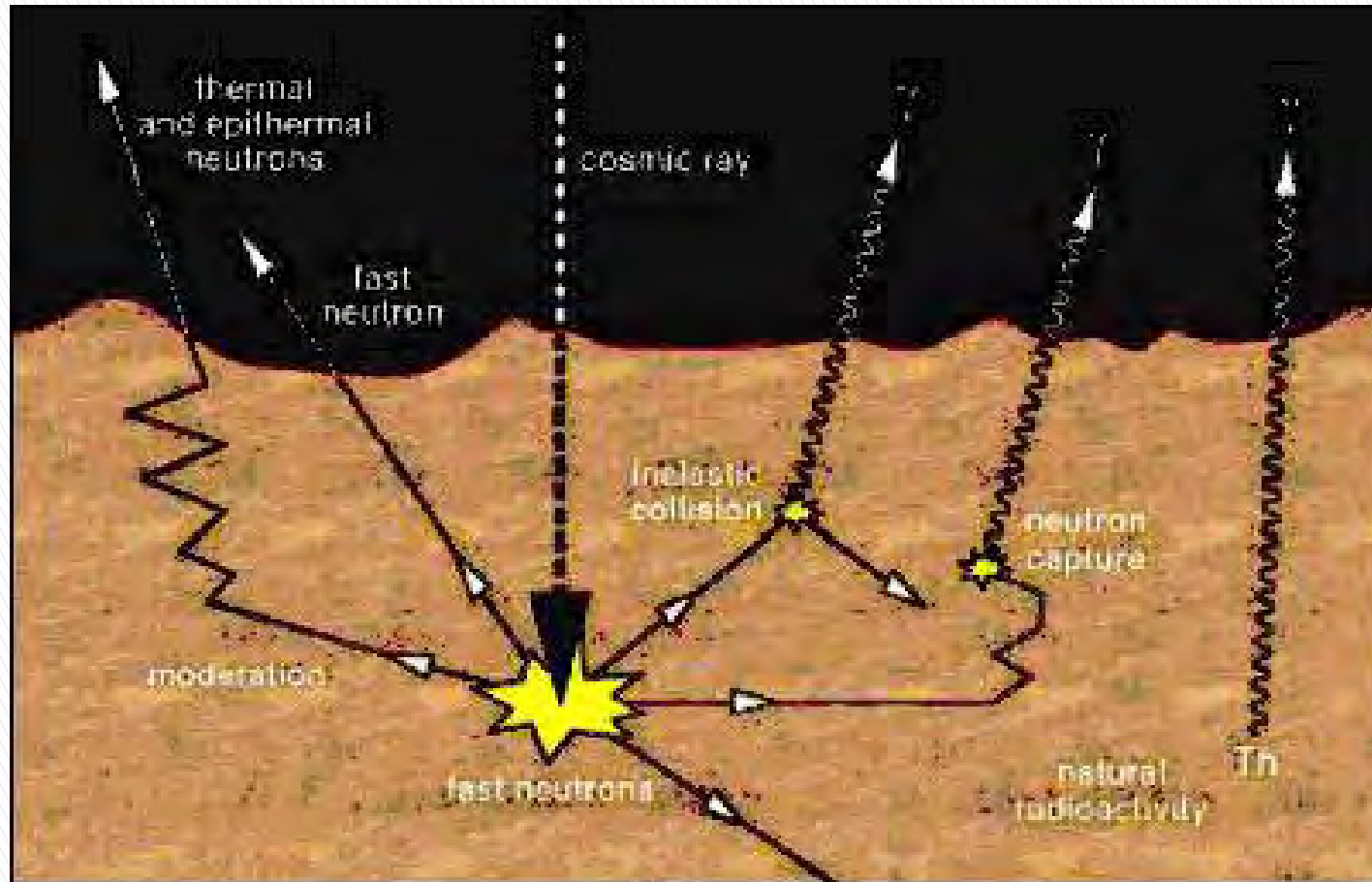
# Lunar Prospector



## Instruments of Interest for Research

- Neutron Spectrometer
- Gamma Ray Spectrometer

# Epithermal Neutrons



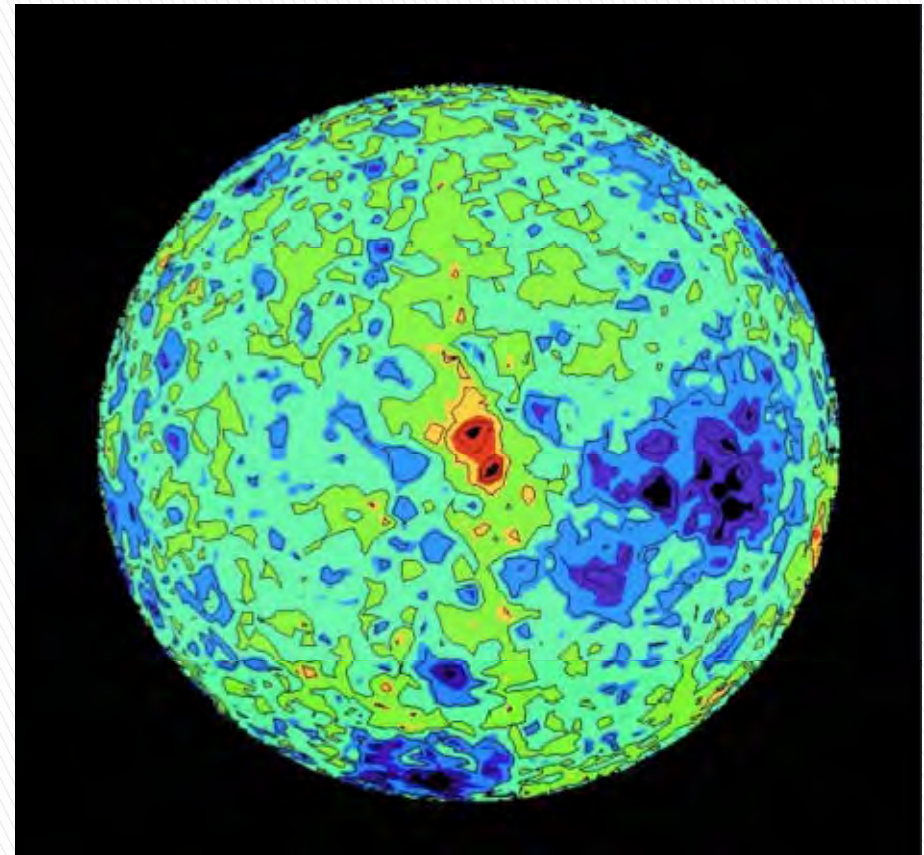
[directory.eoportal.org/.../129/LRO\\_Auto17.jpeg](http://directory.eoportal.org/.../129/LRO_Auto17.jpeg)

# Initial Research

## ▶ Initial Map

- Southern Hemisphere
- Data Set: Neutron Flux
- Resolution:  $2^\circ \times 2^\circ$
- Light: High Hydrogen
- Dark: Low Hydrogen
- Orientation: ?

**WHAT ARE WE LOOKING AT?**

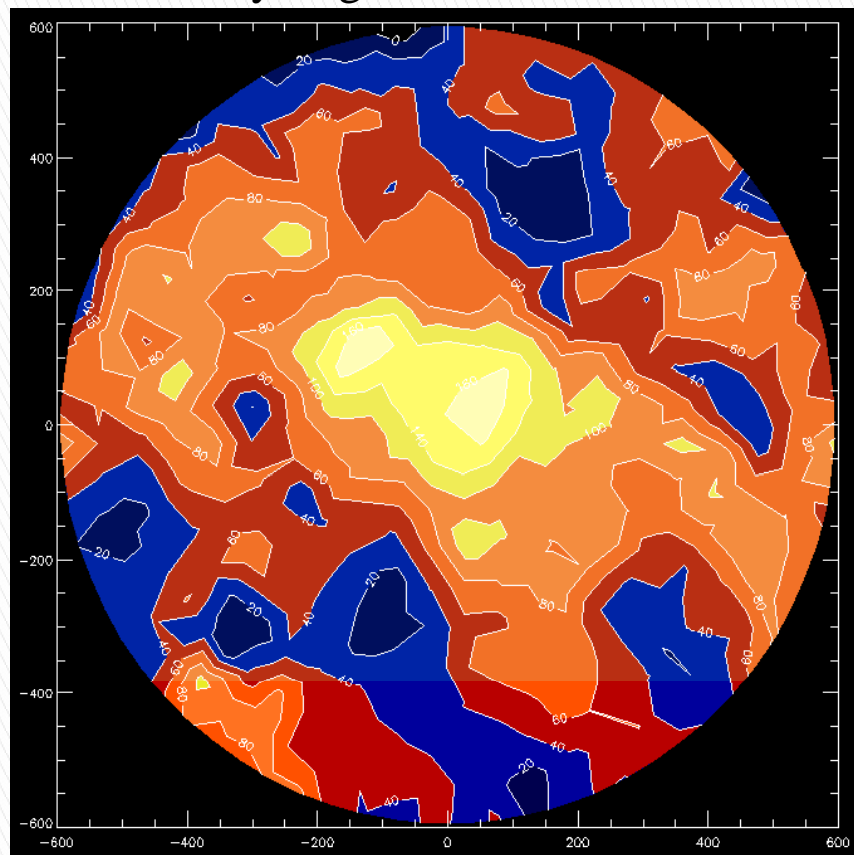


Daniel McNeel, Jose Castellano

# Moment of Recognition

-70° Latitude

Hydrogen: 2° X 2°

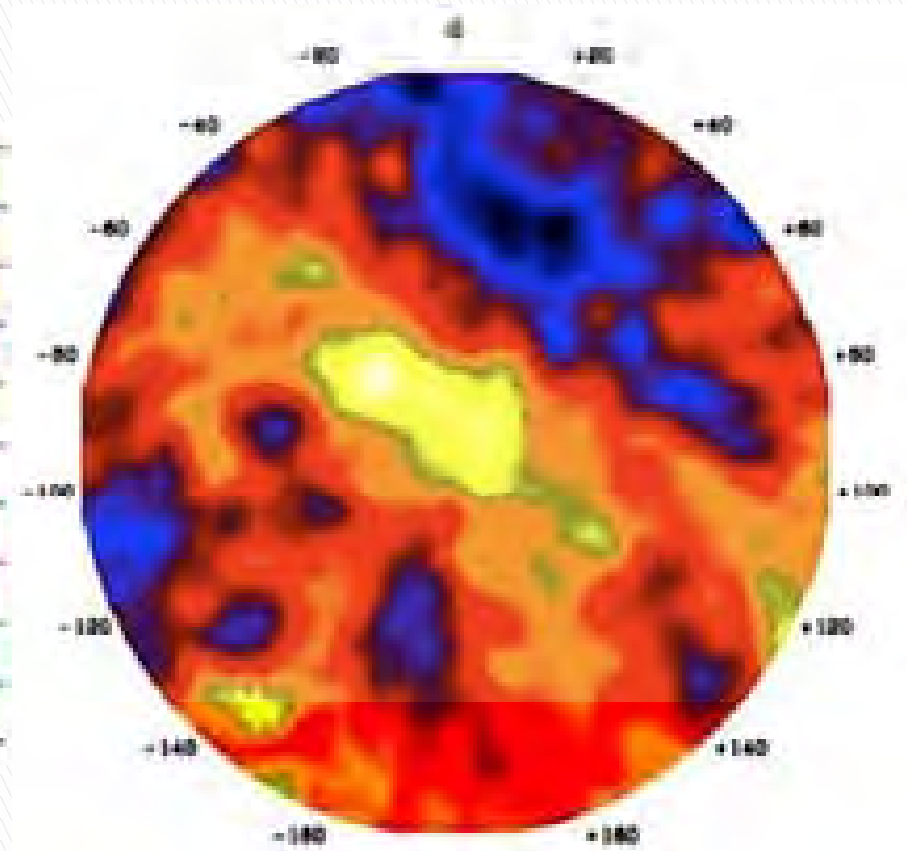


Julia Bodnarik

High



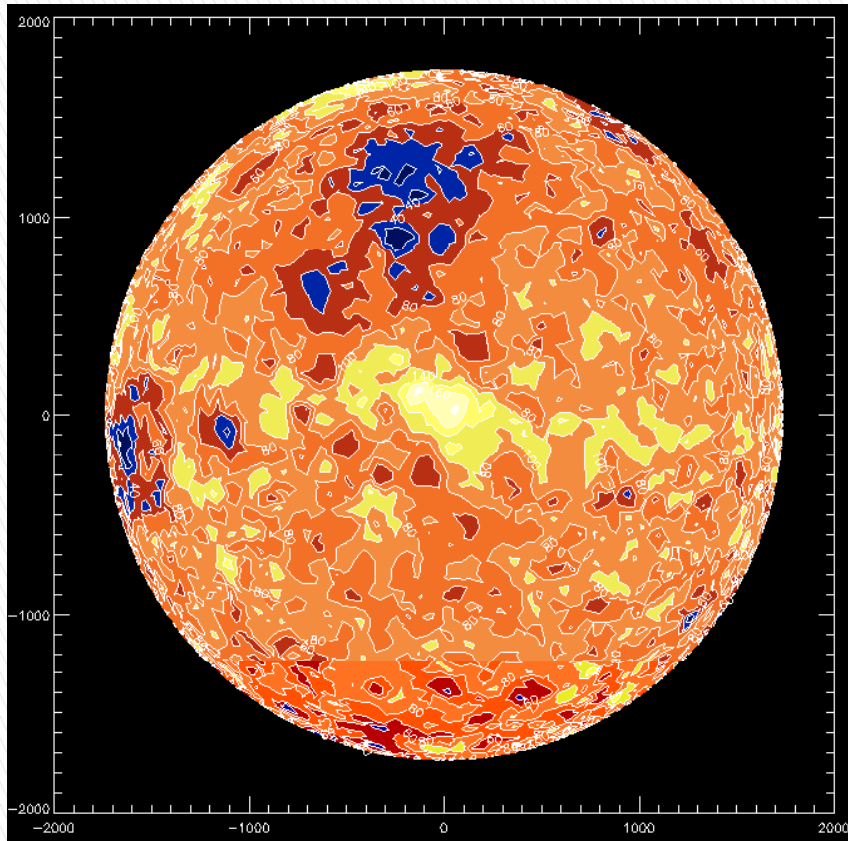
Low



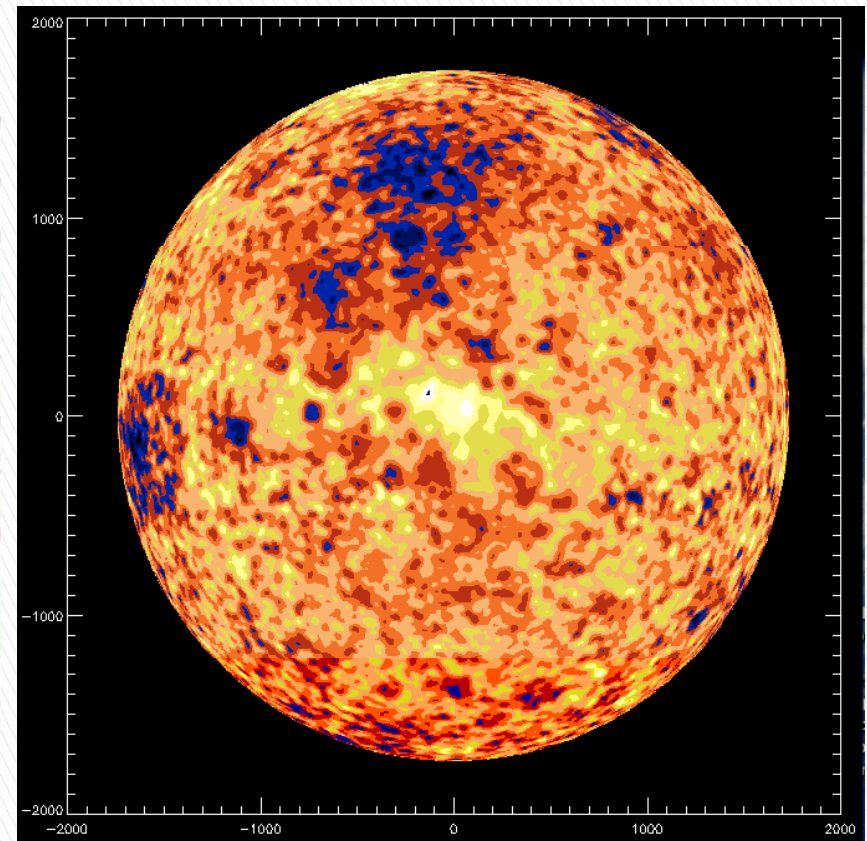
D. Lawrence, Los Alamos National Laboratory

# Higher Resolution Data

Hydrogen  
2° X 2° data set



Hydrogen  
0.5° X 0.5° data set



High

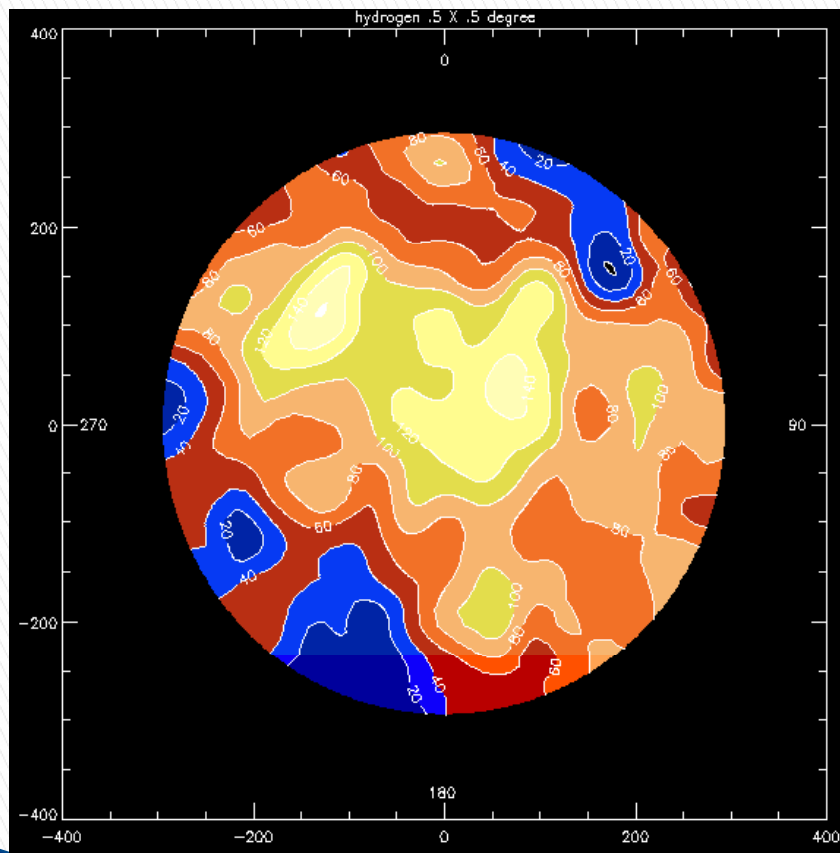


Low

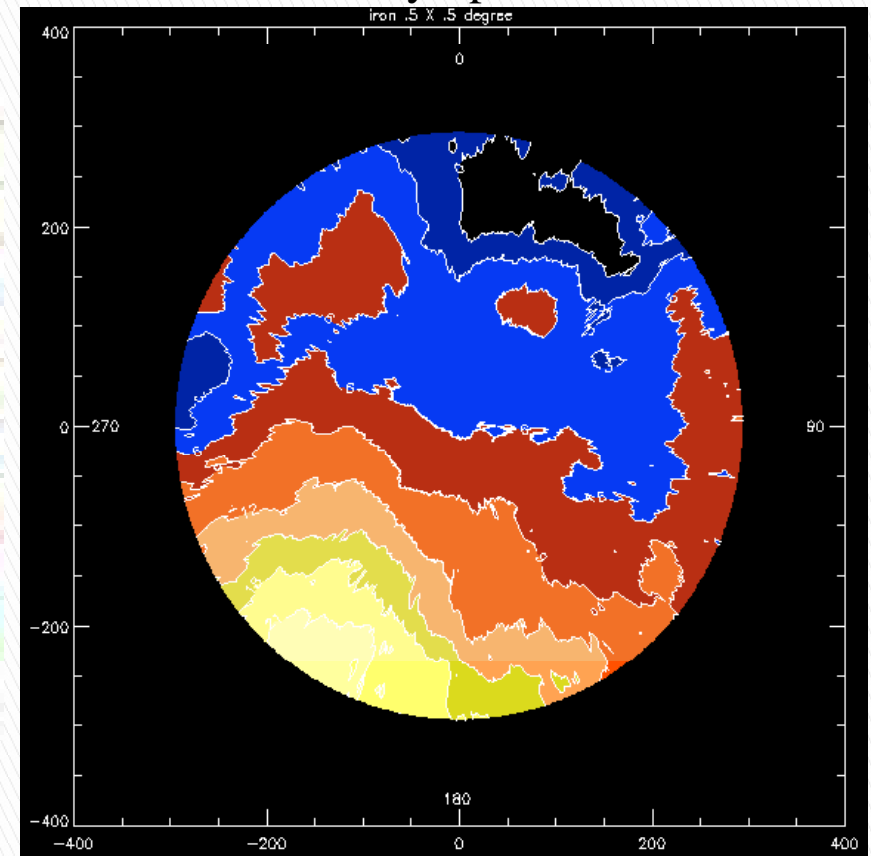
# Cross Correlation

**0.5° X 0.5°  
-80° Latitude**

Hydrogen:  
Neutron Spectrometer



Iron  
Gamma Ray Spectrometer



High

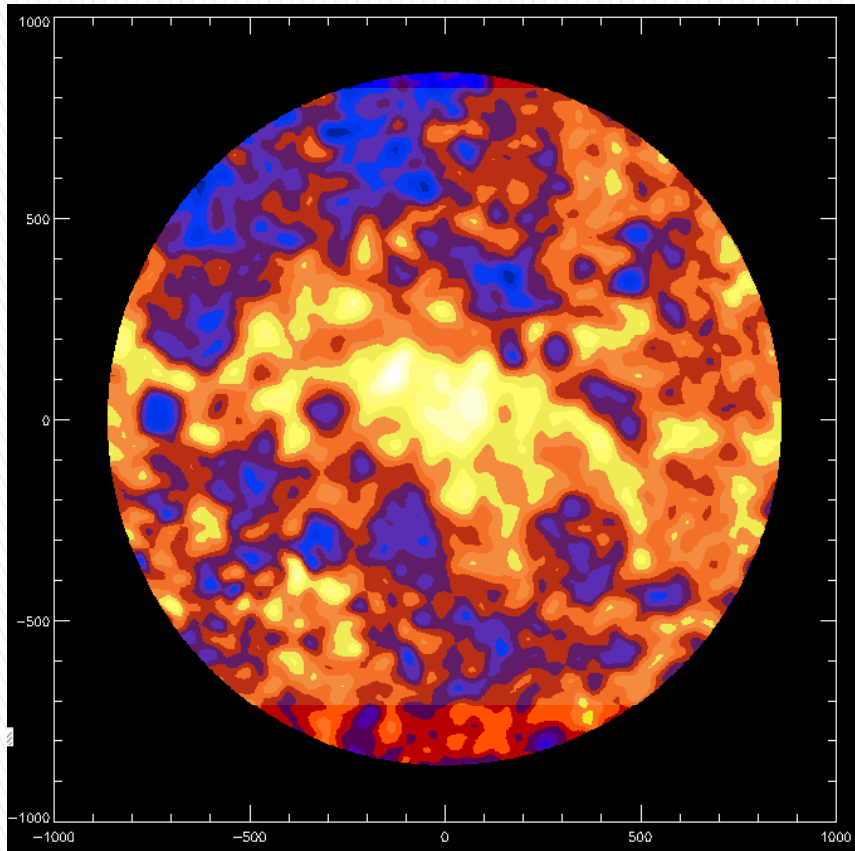


Low

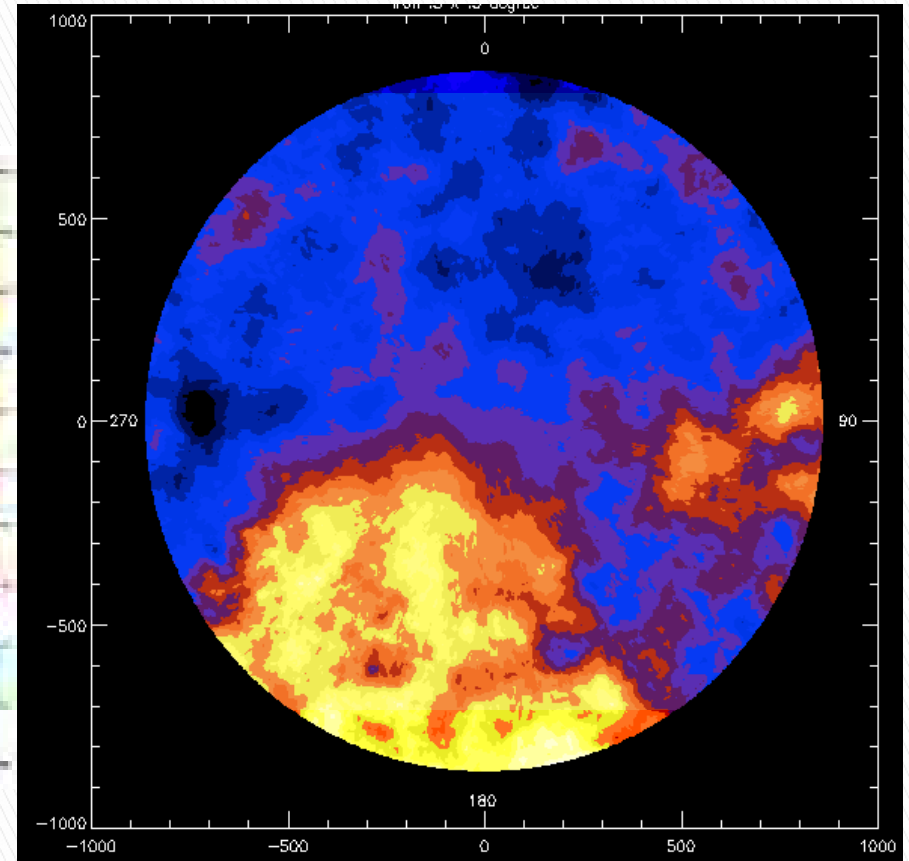
# Cross Correlation

$0.5^\circ \times 0.5^\circ$   
 $-60^\circ$  Latitude

Hydrogen



Iron

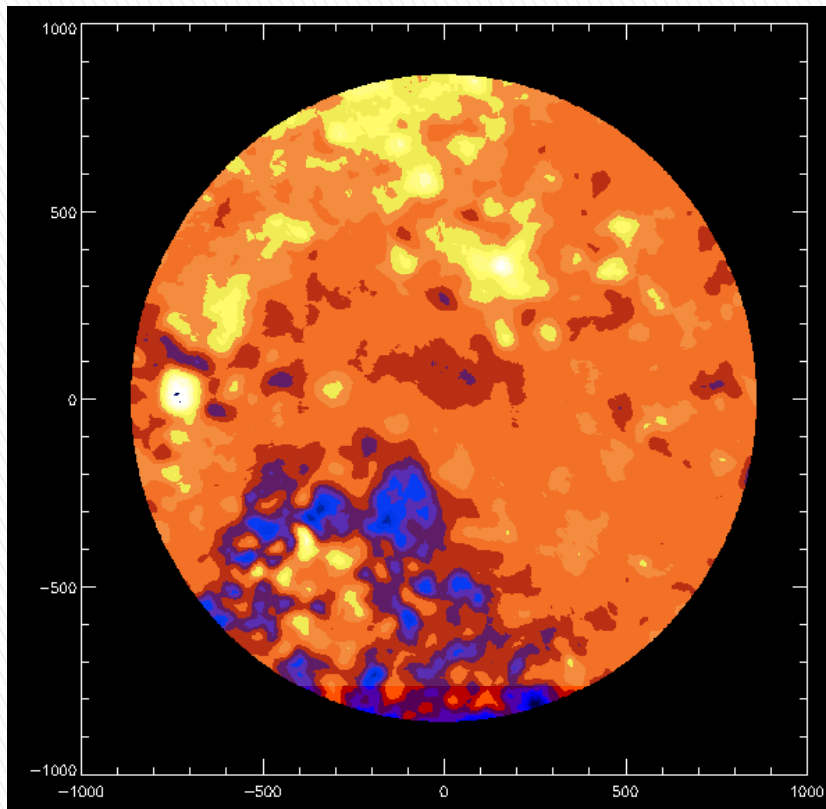


High

Low

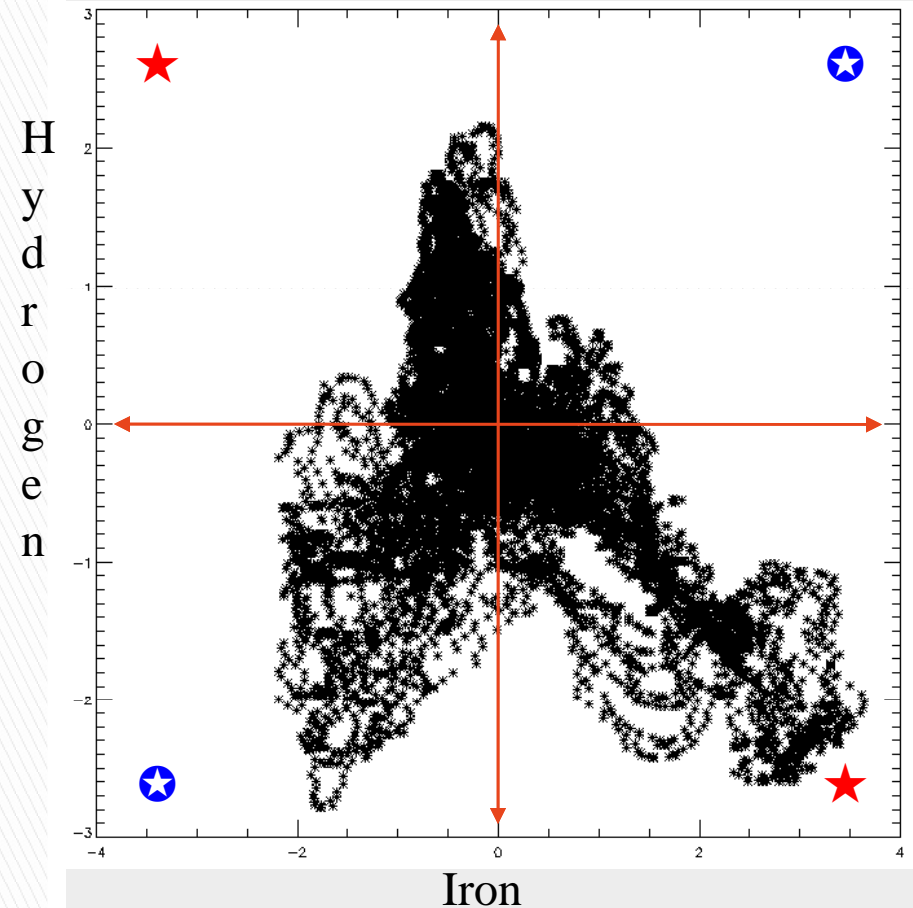
# Covariance

## Hydrogen vs. Iron



# Cross Correlation Plot

## Hydrogen vs. Iron



Vary Apart



Vary Together



# Conclusion and Summary

- ▶ Found Relevance in research done prior to research at NASA
  - Linked similarities in my research and previous research by other scientists
- ▶ Used IDL to create higher resolution maps of hydrogen and Iron content on the lunar surface at different latitudes
- ▶ Mapped the covariance of Iron and Hydrogen content on the moon

# Continuing Research

- Continue to search for other sources that can be mistaken for a hydrogen signature across the lunar southern hemisphere
- Map the northern hemisphere to check for signs of correlation between hydrogen and other elements that might not be as apparent on the southern surface
- Continue to search for evidence of water on the moon.
- ***Lunar Explorer Neutron Detector (LEND)***

# Acknowledgements

- ▶ NASA
  - Tim McClanahan, Larry Evans, Richard Starr
    - Julia Bodnarik, Ian Dougherty
- ▶ American Institute of Physics
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    - Daniel McNeel
- ▶ MU-SPIN
  - James Harrington

*Questions?*