

# Information and Statistics for Nuclear Experiment and Theory (ISNET)

## Welcome ISNET-9



**Department of Physics and the McDonnell Center for the Space Sciences, Washington University in St. Louis**

# Information and Statistics in Nuclear Experiment and Theory (ISNET-9)

May 22-26, 2023

*Hosted by Washington University in St. Louis*

**The mission of the Information and Statistics in Nuclear Experiment and Theory (ISNET) community** is to encourage, facilitate, and develop the use of statistical and computational methodologies to enable nuclear physics to reach more quantitatively rigorous scientific conclusions. We do this by combining domain knowledge from the broad nuclear physics community with expertise in related fields of research, such as statistics, mathematics and computer science.

**Welcome to remote participants:** For 2023, ISNET-9 is a hybrid meeting. All talks will be delivered on-site, but sessions will also be broadcast via Zoom for remote participants.

# A bit of Washington University history in the area of Bayesian Inference



## **EDWIN T. JAYNES ( 1922 - 1998 )**

**born July 5, Waterloo, Iowa, 1922, US.**

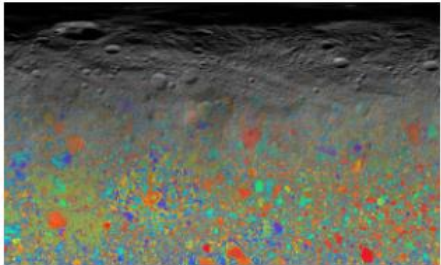
**died Apr. 30, 1998, St. Louis, Missouri, US.**

Edwin Thompson Jaynes (July 5, 1922 – April 30, 1998) was Wayman Crow Distinguished Professor of Physics at Washington University in St. Louis. He wrote extensively on statistical mechanics and on foundations of probability and statistical [inference](#), initiating in 1957 the [MaxEnt interpretation of thermodynamics](#), as being a particular application of more general Bayesian/information theory techniques (although he argued this was already implicit in the works of Gibbs). A particular focus of his work was the construction of logical principles for assigning prior probability distributions; see the [principle of maximum entropy](#), the principle of transformation groups and Laplace's principle of indifference. His last book, "[Probability Theory: The Logic of Science](#)" gathers various threads of modern thinking about [Bayesian](#) probability and statistical inference, and contrasts the advantages of Bayesian techniques with the results of other approaches.

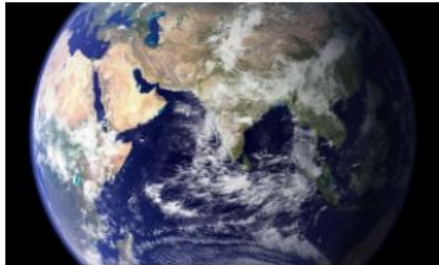
G. Larry Bretthorst, 1988, *Bayesian Spectrum Analysis and Parameter Estimation*, in *Lecture Notes in Statistics 48*, Springer-Verlag, New York: Bayesian spectrum analysis is still in its infancy. It was born when E. T. Jaynes derived the periodogram as a sufficient statistic for determining the spectrum of a time-sampled data set containing a single stationary frequency...

## Research

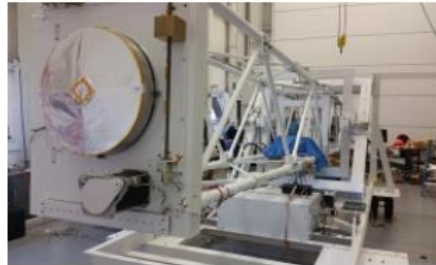
TOPICS COVERED INCLUDE THE STRUCTURE OF THE UNIVERSE, STARS, PLANETS, METEORITES,  
THE MOON AND EARTH, AND ORIGINS OF THE SOLAR SYSTEM



Cosmochemistry and  
Astromaterials



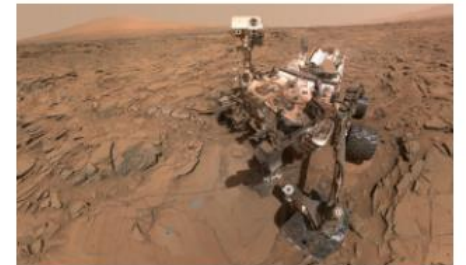
Earth as a Planet



Experimental, Observational  
and Theoretical Astrophysics

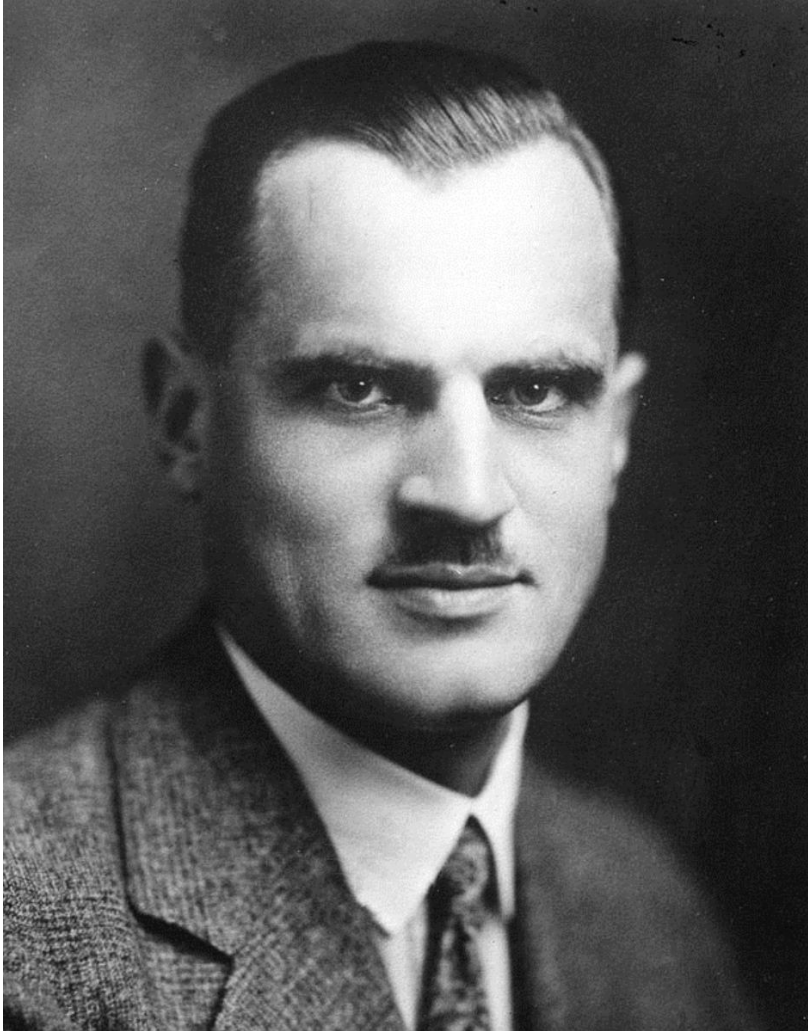


Particle and Nuclear Physics,  
Cosmology and Gravitation



Planetary Exploration and  
Habitability

# Another bit of Washington University history of interest



## **Arthur Holly Compton**

Wayman Crow Professor  
of Physics and  
Department Head,  
1920-1922

Nobel Prize in  
Physics, 1927

Chancellor of  
WashU 1946-1954

Directed the work  
resulting in the first  
atomic chain reaction

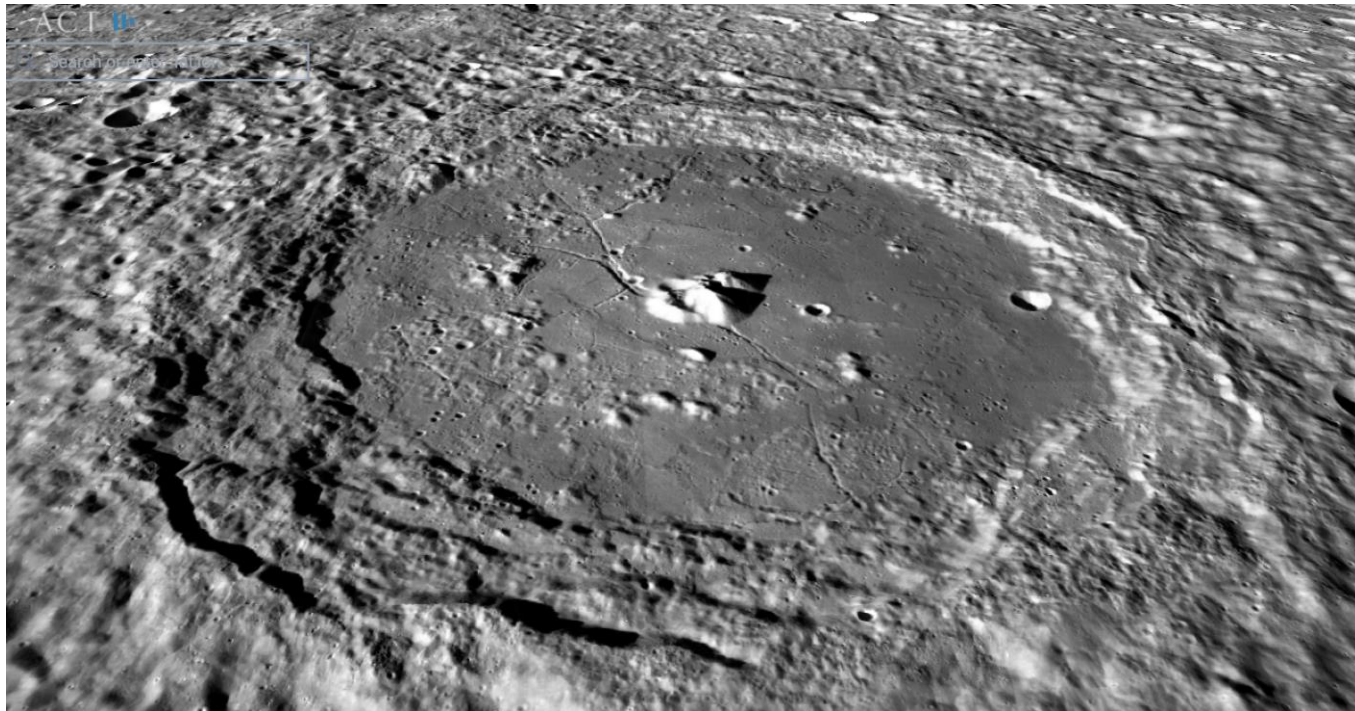
Discovered the Compton effect  
(1923) – demonstrated the  
particle nature of electro-  
magnetic radiation

The Compton Gamma Ray Observatory released  
into Earth orbit in 1991; NASA/Ken Cameron

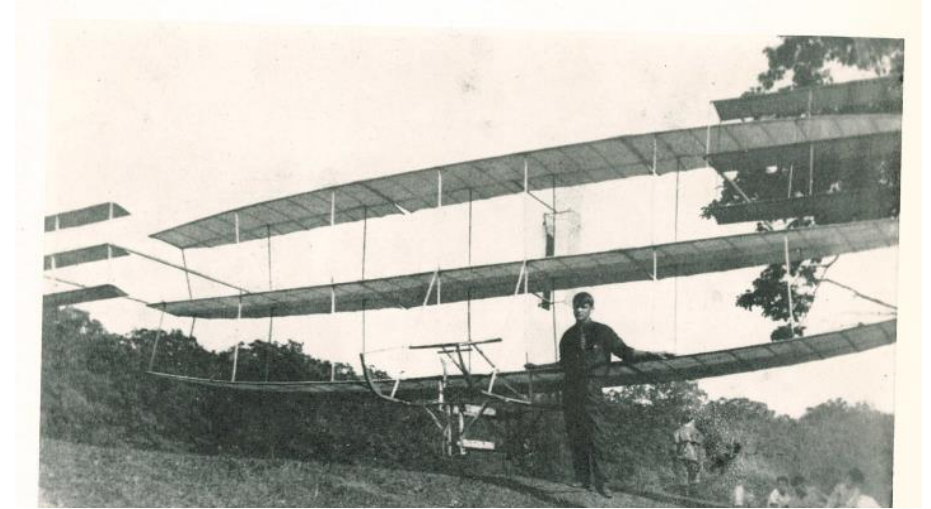


## Another bit of Washington University history of interest

**Arthur Holly Compton** and his brother Karl were honored posthumously with the naming of a crater on the Moon. The only such crater named for brothers.



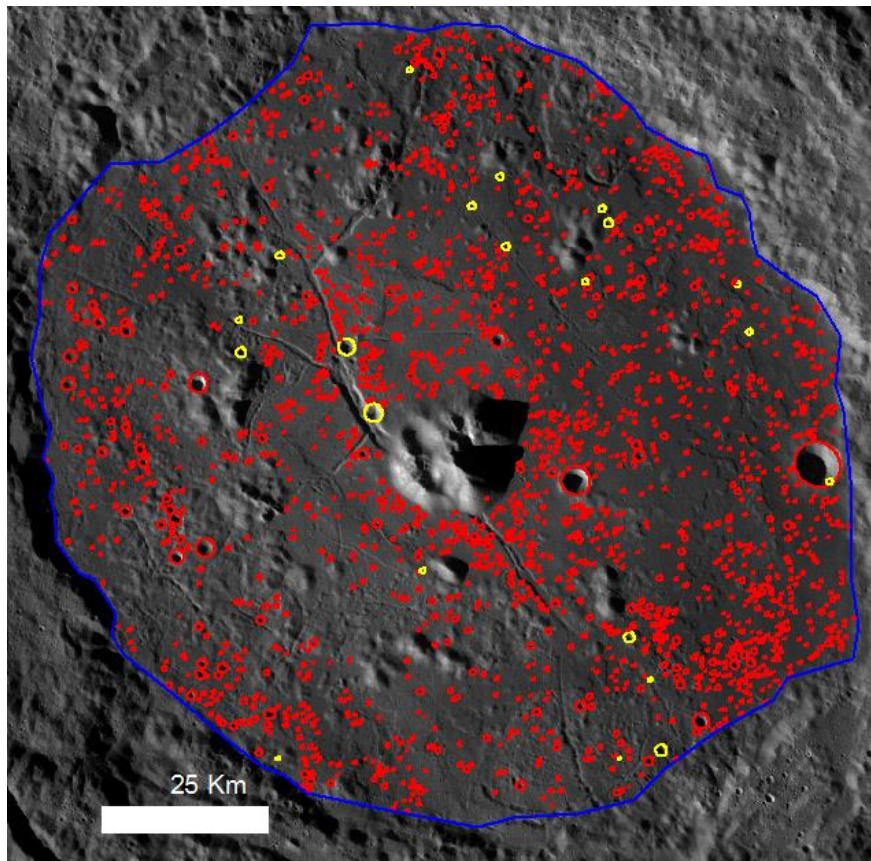
Compton with the glider he built, age 16



The photograph of Dr. Compton on the inside front cover shows an early interest of the scientist not so well known. He is standing beside a glider he built in 1909 when he was 16 years old, just six years after the first airplane flight of the Wright brothers. He has described how he built the glider after a year working with model airplanes trying to determine the conditions necessary for stable flight. Finally he built the glider: "I did all the work and the sewing of the muslin surfaces myself. Tools—Mother's scissors and sewing machine, Father's plane and try-square, my own pliers and screw driver and pocket knife. The total cost of the machine was between thirty and thirty-five dollars."

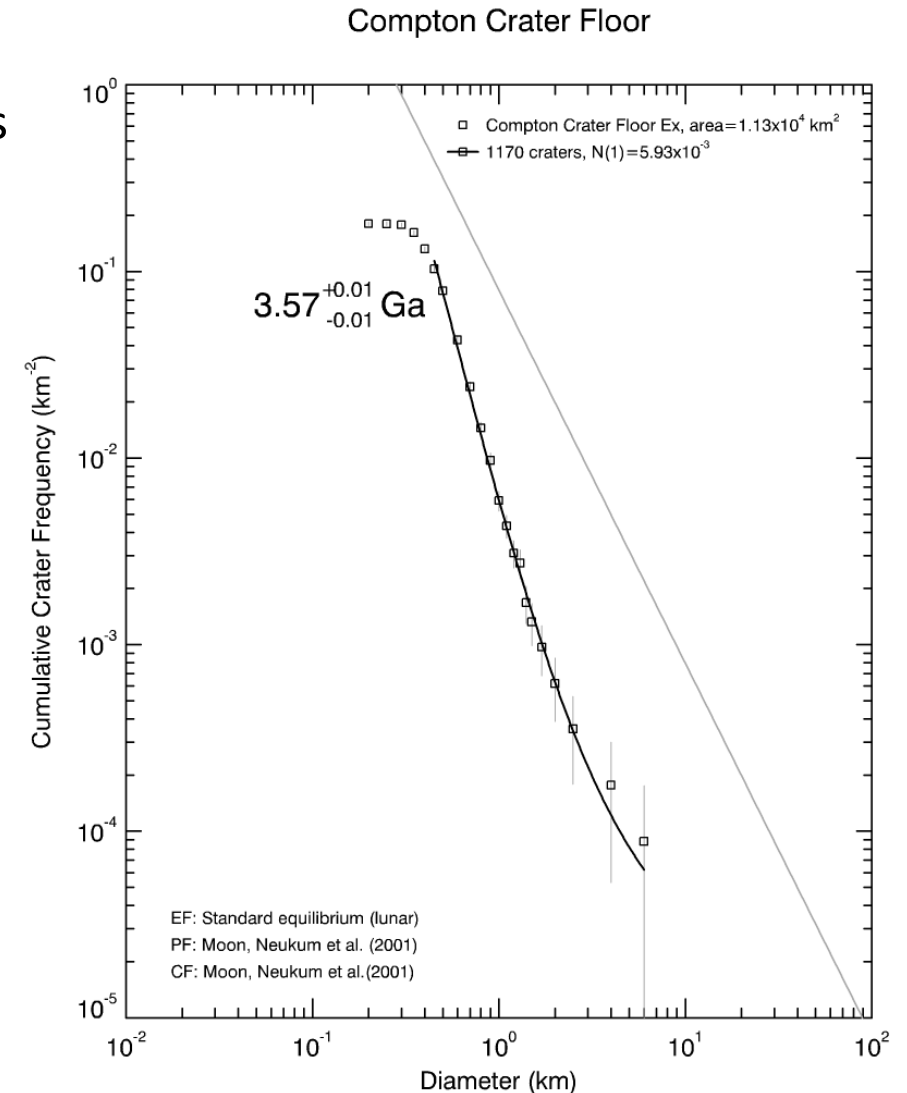
# Improvements to this method are using Bayesian Inference

Determining the age of Compton Crater using crater size-frequency distribution analysis.. The most up-to-date methods make use of Poisson statistics and Bayesian inference.



2087 craters, 21 uncertain (yellow)

Shirley, K., M. Zanetti, B. Jolliff, C. v. d. Bogert, and H. Hiesinger (2016) Crater size-frequency distribution measurements and age of the Compton-Belkovich Volcanic Complex. *Icarus* **273**, 214-223.



Model age fit to craters 450-6000 m in diameter