NISTTech

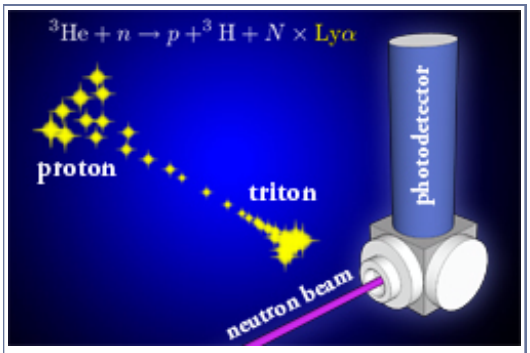
Portable Optical Neutron Detector

Lyman-alpha Neutron Detector (LAND), Far Ultraviolet Dosimeter For Slow Neutron Detection

Description

This optical method detects individual neutrons and records them over a range of intensities. The detector is based on the discovery that when neutrons are absorbed in a helium isotope gas, the resulting reaction causes the gas to emit strong amounts of radiation in the ultraviolet spectrum known as Lyman alpha radiation. The amount of Lyman alpha radiation is measured by the new device known as the Lyman-alpha neutron detector (LAND).

Images



Neutron absorption by 3He yields tens of Lyman alpha photons, which result from the most fundamental energy jump in the hydrogen atom. This schematic illustrates the operation of a prototype Lyman alpha neutron detector (LAND). Credit: NIST

NIST Lyman alpha neutron detector(LAND), shown with a U.S. dollar coin for scale, is now the world's most sensitive neutron detector. Credit: NIST

Applications

- **Energy**
  Nuclear reactor operations and oil well logging.
- **First responders and defense**
  Personal protective equipment for first responder and military personnel.
- **Research**
  Monitoring special nuclear materials, fundamental physics experiments and materials science applications.

Advantages

- **Sensitive**
  Can detect and record a single or a large number of neutrons over a range of sensitivities.
- **Robust and simple**
  Relatively simple, compact, and robust; less susceptible to gamma rays.
- **Easy to produce**
  Simple fabrication technique and requires no ultrahigh purity gases.
- **Stable and precise**
  Very stable and can be calibrated absolutely.

Abstract

A method and apparatus for detecting slow neutrons by monitoring Lyman alpha radiation produced by the .sup.3He(n,tp) nuclear reaction induced by neutrons incident on a gas cell containing .sup.3He or a mixture of .sup.3He and other atoms and/or molecules. Such a method and/or apparatus includes the use of, for example, liquid .sup.3He and .sup.4He mixtures as a scintillation counter for the sensitive detection of neutrons using Lyman alpha radiation produced by the .sup.3He(n,tp) reaction. The radiation can be detected with high efficiency with an appropriate photo-detector, or alternatively, it can be converted to radiation at longer wavelength by absorption in scintillation materials, with the radiation channeled to a photodetector. Because of the simplicity of the system and the fact that the radiation production mechanisms can be measured and/or calculated independently, the method and/or apparatus also has the potential for service as a calculable absolute detector.

Inventors

- Thompson, Alan Keith

- Coplan, Michael A.
- Clark, Charles W.

Related Items

- New NIST Detector Can 'See' Single Neutrons Over Broad Range

References

- U.S. patent # 7,791,045 issued 09-07-2010, expires 07/29/2028
- Docket: 07-016

Status of Availability

active patent and available for licensing

Last Modified: 10/21/2010