UNIVERSITY OF NOTRE DAME
DEPARTMENT OF PHYSICS
COLLEGE OF SCIENCE

NUCLEAR SEMINAR

Speaker: **Matt Bowers**
University of Notre Dame

Title: ***Experimental Results of the $^{33}S(\alpha,p)^{36}Cl$ Cross Sections: Implications on ^{36}Cl Production in the Early Solar System***

Date: Monday, November 19, 2012

Time: **4:00 pm EST**

Place: Nieuwland Science Hall Room 124

*Refreshments will be served prior to the seminar in room 124.

ALL INTERESTED PERSONS ARE CORDIALLY INVITED TO ATTEND

Short-lived radionuclides (SLRs) with lifetimes $\tau < 100$ Ma are known to have been extant when the Solar System formed 4.568 Ga years ago. Identifying the origins of SLRs can provide insight into the origins of our Solar System and the processes that shaped it. Those SLRs with the longest lifetimes have abundances expected from steady state production throughout the galactic medium. There are two proposed production scenarios for the origins of SLRs with $\tau < 5$ Ma. Freshly synthesized material could be incorporated in the Solar System by a nearby stellar source (e.g., super nova, AGB star, Wolf-Rayet star), or SLRs could have also been produced by the bombardment of gas and dust by solar energetic particles emitted by our young Sun. The origin of extinct ^{36}Cl in the early Solar System is thought to have been produced by local particle irradiation. The models that attempt to recreate the production of ^{36}Cl in the early Solar System lack experimental data for the nuclear reactions considered.

We measured the reaction cross sections for the $^{33}S(\alpha,p)^{36}Cl$, an important reaction in the production of ^{36}Cl. The cross section measurement was performed by bombarding a target and collecting the recoiled ^{36}Cl atoms produced in the reaction, chemically processing the samples, and measuring the $^{36}Cl/Cl$ concentration of the samples with accelerator mass spectrometry (AMS). The cross section was measured at six energies that ranged from 0.70 up to 2.42 MeV/A. The cross sections calculated with the TALYS code under predicted those measured by a factor of ~3 at lower energy and are in agreement at higher energy. The cross sections used in the irradiation models were in worse agreement with the data than those calculated using TALYS. The new results are compared using the x-wind framework of local irradiation in the early Solar System. A sensitivity study was also performed to determine what environmental factors change which reactions are most important in ^{36}Cl production.