# CALIFORNIA STATE SCIENCE FAIR
## 2004 PROJECT SUMMARY

**Name(s)**
David A. Woodbury

**Project Number**
**S1524**

**Project Title**
# Shielding of Neutron Emission Ratio Observer from Neutrons Produced by Cosmic Rays

**Abstract**

**Objectives/Goals**
To investigate the cosmic ray neutron attenuation effects of passive and active shielding on the neutron emission ratio observer (NERO), a low-energy neutron detector.

**Methods/Materials**
Passive shielding consisted of water, boron carbide, and a combination of the two materials. Active shielding consisted of a VETO gate using the inputs of the neutron detector and a coincidental signal from two plastic scintillators.

**Results**
Boron carbide absorbed 13% of neutrons, water 42%, and a combination of the two, 48%. Active shielding was shown to reject NERO signals, and the rejected signals were shown to have been confined to the neutron-specific energy ranges.

**Conclusions/Discussion**
Both boron carbide, water, and a combination of the two were shown to be effective neutron attenuators. Active shielding was shown to be effective, but because of a short time window in which NERO signals were rejected, only about 0.7% of the total neutrons were rejected. This problem could be fixed by using a longer time window to account for the difference in processing speed between the scintillators and neutron detector.

**Summary Statement**
My project tests the effectiveness of shielding a low-energy neutron detector from neutrons produced by cosmic rays.

**Help Received**
Participant in Michigan State University High School Honors Science Program. Used lab equipment at National Superconducting Cyclotron Laboratory at Michigan State University under the supervision of Dr. Hendrik Schatz. NERO is sponsored by the Joint Institute for Nuclear Astrophysics.