BNL 12981

CONF-680936--1

MASTER

RECEIVED BY DTIE DEC 2 1968

A Search for Neutrinos from the Sun*

Raymond Davis Jr.

Chemistry Department, Brookhaven National Laboratory, Upton, New York 11973, U.S.A.

Abstract

A solar neutrino detector has been built that is based upon the $Cl^{37}(\nu, e^-)Ar^{37}$ reaction. The detector uses 3900,000 liters of tetrachloroethylene as the neutrino capturing medium. Argon is removed from the liquid by sweeping with helium gas, and counted in a small low level proportional counter. The recovery efficiency of the system was tested with Ar^{36} by the isotope dilution method, and also with Ar^{37} produced in the liquid by fast neutrons. These tests demonstrate that Ar^{37} produced in the liquid by neutrino capture can be removed with a 95 percent efficiency by the procedure used.

Initial results with the detector show that the neutrino capture rate was less than 0.5 per day, corresponding to a total neutrino flux-cross section product of less than 3×10^{-36} sec^{-1}. From this limit and the cross sections of Bahcall, the following conclusions were drawn: (1) the flux of neutrinos from B^8 decay in the sun was less than 2×10^6 cm^{-2} sec^{-1}; (2) less than 9 percent of the sun's energy is produced by the CNO-cycle; and (3) the extraterrestrial flux of 1, 10, and 100 MeV neutrinos is less than 5×10^9, 13×10^5, and 4×10^2 cm^{-2} sec^{-1}, respectively.

The ultimate detection sensitivity of the present experiment is limited by background effects from cosmic radiation and internal contamination with natural alpha emitters. Knowledge of the magnitude of these background effects show that the ultimate neutrino detection sensitivity can be increased five-fold. A brief survey is given of possible low threshold radiochemical neutrino detection techniques that could be used for observing low energy neutrinos from the sun.