A Search for Neutrinos from the Sun*

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Introduction

A solar neutrino detection system has been built to observe the neutrino radiation from the sun. Neutrino detection depends upon observing Ar^{37} produced in 610 tons of tetrachloroethylene (C_2Cl_4) by the neutrino capture reaction $Cl^{37}(\nu, e^-)Ar^{37}$. The apparatus was completed in early 1967, and initial measurements were performed. Argon-37 was not observed in these experiments, and from the sensitivity of the counting measurements it was only possible to set an upper limit to the solar neutrino flux.[1] The total neutrino capture rate in Cl^{37} was found to be less than or equal to 3×10^{-36} sec^{-1}. Of particular interest was the flux of neutrinos from the decay of B^8 in the sun. The upper limit to the flux of B^8 neutrinos was 2×10^6 cm^{-2} sec^{-1}, approximately a factor of seven below the flux predicted at that time by solar model calculations.[2,3] However, there became available a new measurement of the carbon, nitrogen and oxygen composition of the sun, and some additional nuclear data. When this new information was introduced into the solar model calculation the predicted B^8 flux was reduced by a factor of three.[4] The present status of these solar model calculations will be discussed at this conference by Dr. Bahcall. A summary of his results is given in Table I. This table lists the fluxes of neutrinos from various processes occurring in the sun, and the corresponding neutrino capture cross sections in Cl^{37}. These calculations predict a total neutrino capture rate in Cl^{37} of 0.6×10^{-35} sec^{-1}. It is interesting to note that