depends on the difference in masses between the neutrino types, and on the mixing angle. The electron neutrino must be the lightest of the neutrinos and at least one other neutrino must have a mass close to that of the electron neutrino. This phenomenon could result in a distortion of the normal ^{8}B neutrino spectrum and account for the low observed neutrino capture rate in ^{37}Cl[10]. For certain values of the neutrino mass differences ($10^{-4} eV^2 \gtrsim \Delta m^2 \gtrsim 10^{-6} eV^2$) and mixing angles ($0.086 \leq \sin\theta \leq 0.52$) a day-night effect may be observable with the ^{37}Cl solar neutrino detector[11]. The University of Pennsylvania is planning to search for a day-night effect with this detector. It can be accomplished by increasing the helium gas purging rate so that an ^{37}Ar sample can be recovered in 4 to 5 hours.

It was suggested by Okun, Voloshin, and Vysotsky[12] that if the neutrino is a massive Dirac particle with a magnetic or electric dipole moment, its spin could be flipped in passing through the magnetic fields in the Sun. In this case, the neutrino would not be detectable. This mechanism could account for variations in the ^{37}Ar production rate with solar activity. This process would be important if the neutrino had a magnetic moment of the order of 10^{-10} Bohr magnetons for magnetic fields of a few thousand gauss.

We now address the question of the constancy of the ^{37}Ar production rates observed in the chlorine detector. There are strong indications that the rate varies with the solar activity cycle, and that large solar flares produce sudden increases in the rate. These matters must be understood before one can interpret the results fom the chlorine detector in terms of the solar model, solar structure, and neutrino interactions.

3. Solar Flare Enhancements. It was pointed out by Bazilevskaya et al.[13] that three large solar flares (August 4, 1972; September 19, 1977, October 10, 1981) correlate in time with high ^{37}Ar production rates in the chlorine detector during runs#27,#51, and#71 (1.23±.41 ^{37}Ar/day; 0.85±.33 ^{37}Ar/day; 1.21±.37 ^{37}Ar/day, respectively). They compared the observed ^{37}Ar production rate with solar flare proton intensities ($\gtrsim$150Mev) measured at the top of the atmosphere. In addition, the largest flare observed by the solar maximum mission occurred on August 5, 1984, during the exposure interval of run#86 (1.26±.57 ^{37}Ar/day).[15] Monte Carlo simulations of the experimental data, assuming a steady neutrino source with an average production rate of 0.47 ^{37}Ar/day, show that one may expect to observe an average of one run with an ^{37}Ar production rate of 1.2 atoms/day in a set of 68 measurements. The three events that were observed are not inconsistent with expectation. However, when one considers that during the three highest runs observed in 68 measurements (#27, 71, 86)there occurred very large solar flares, and that these flares were the largest ones observed in that period, the chance of correlation is very unlikely. The flares which correlate with high ^{37}Ar production rates are flares in which gamma rays and neutrons were observed (October 10, 1981, and August 5, 1984).

Observing the neutrino flux and energy spectra from flares can give important information on acceleration mechanisms. Large scintillation and Cerenkov neutrino detectors are now capable of observing time-correlated neutrino bursts[16]. One may look forward to testing the indicated correlations of ^{37}Ar enhancements from the chlorine detector.

4. Correlation with Solar Activity. A number of authors have analyzed the observed ^{37}Ar production rate for periodicities[17], and for correlations with solar activity[13,18]. Figure 1 shows a plot of the 5-point running averages of the ^{37}Ar production rate, compared to the smoothed sunspot numbers. Note that the ^{37}Ar production rate drops from 0.8±0.15 atoms/day to 0.1±0.1 atoms/day with the onset of solar cycle #21. From 1977 to the end of our observations in 1985, the ^{37}Ar production rate anti-correlates with sunspot numbers in a systematic and organized way. Figure 2 shows the systematic anti-correlation for this period. Prior to 1977, the ^{37}Ar production rate is constant and consistent with the errors. The linear correlation coefficient for the period 1977-1984 is 0.80, using all experimental points.