STATISTICAL ANALYSIS OF A "COLD FUSION" EXPERIMENT

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Yagi et al recently have claimed that neutrons from the $D + D$ reaction are emitted in Ti and in SiO$_2$ systems in which D$_2$ is trapped at $\sim$1 atm at liquid nitrogen temperature. A statistical analysis of the data shows that the background counts observed over 58 time intervals do not follow the expected Poisson distribution. This would invalidate the interpretation of the results.

INTRODUCTION

Yagi et al. have recently searched for neutrons emitted from 100-200 g Ti and 50-100 g SiO$_2$ samples in various physical forms, in which D$_2$ at $\sim$1 atm was trapped at $-196 \, ^\circ C$ and subsequently degassed at temperatures as high as 600 $^\circ C$. Neutrons could be detected in a 100 cc liquid organic scintillation detector (NE-213), using rise time discrimination against $\gamma$-rays. The de-

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Detector was placed at 6 cm from the quartz ampoule containing the samples. Detection was restricted to neutrons between 1.5 and 5 MeV energy. Most of the measurements were made in standard time intervals of 1000 sec. Typically, ~30 to ~60 such intervals were used for a given sample.

The background was measured either by not treating the sample with D₂ or by using only the blank sample ampoule. In Ref. (2), the number of counts per 1000 sec is shown for two background runs, totaling 58 intervals. The average background rate was 3.26 counts/interval. Despite this mean rate, the number of counts per interval never exceeded 5 in any of the 58 intervals, a statistical occurrence which seemed to me to be most unlikely. For this reason, I undertook a statistical analysis of some of the data presented in Refs (1) and (2).

STATISTICAL ANALYSIS

Theory

Even if one hypothesizes that external conditions, such as the temperature of the sample or the deuterium content of the samples, affect the detected counts, there should be no such effect on the background counts. The latter should be randomly fluctuating according to a Poisson distribution ³:

$$P_p(i) = \frac{\mu^i e^{-\mu}}{(i!)}$$

(1)

where P is the probability of finding i counts ($i = 0, 1, 2, \ldots$) in a standard time interval, and $\mu$ is the mean number of counts per interval. If, in an experiment with N