Astrophys Space Sci (2012) 342:9–13
DOI 10.1007/s10509-012-1148-9

ORIGINAL ARTICLE

Study of nuclear decays during a solar eclipse: Thule Greenland 2008

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Received: 1 May 2012 / Accepted: 7 June 2012 / Published online: 20 June 2012

Abstract Recent efforts to determine the cause of anomalous experimental nuclear decay fluctuations suggests a possible solar influence. Here we report on the results from several nuclear decay experiments performed at Thule Air Base in Greenland during the solar eclipse on 1 August 2008. Thule was ideal for this experiment due to its proximity to the magnetic north pole which amplified changes in the charged particle flux and provided relatively stabilized conditions for nearly all environmental factors. An exhaustive list of relevant factors were monitored during the eclipse to help rule out possible systematic effects in the event of unexpected results. We included measurements of temperature, pressure, and humidity as well as power supply outputs, neutron count rates, and the Earth's local electric and magnetic fields. Nuclear decay measurements of ^{14}C, ^{90}Sr, ^{99}Tc, ^{210}Bi, ^{234}Pa, and ^{241}Am were made using Geiger-Müller (GM) ionization chambers. Although our data exhibit no evidence for a statistically significant change in the decay rate of any nuclide measured during the 1 August 2008 solar eclipse, small anomalies remain to be understood.

Keywords Radioactive decay · Solar eclipse

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1 Introduction

Recent investigations of nuclear decays have shown that several unrelated experiments exhibit significant fluctuations inconsistent with the usual nuclear decay law (Javorsek et al. 2009; Fischbach et al. 2009). These reports motivated follow-on studies which supported both conventional (Semkow et al. 2009; Norman et al. 2009; Cooper 2009) and unconventional (Jenkins et al. 2009) explanations of the anomalies. Among the conventional explanations, environmental influences on the detectors have been cited as a possible explanation of the observed effects (Semkow et al. 2009). However, subsequent analyses of possible environmental influences on detectors (Jenkins et al. 2010) have excluded such effects as significant factors. Additionally, rigorous spectral analyses (Javorsek et al. 2010a, 2010b; Sturrock et al. 2010a, 2010b, 2011) of past nuclear decay experiments has helped rule out environmental effects as well as provided some explanation for the results of Norman et al. (2009). These analyses also establish the presence of periodicities within the data and attributes them to a solar origin.