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Solar Influence on Nuclear Decay Rates: Constraints from the MESSENGER Mission

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We have analyzed Cs-137 decay data, obtained from a small sample onboard the MESSENGER spacecraft en route to Mercury, with the aim of setting limits on a possible correlation between nuclear decay rates and solar activity. Such a correlation has been suggested recently on the basis of data from Mn-54 decay during the solar flare of 13 December 2006, and by indications of an annual and other periodic variations in the decay rates of Si-32, Cl-36, and Ra-226. Data from five measurements of the Cs-137 count rate over a period of approximately 5.4 years have been fit to a formula which accounts for the usual exponential decrease in count rate over time, along with the addition of a theoretical solar contribution varying with MESSENGER-Sun separation. The indication of solar influence is then characterized by a non-zero value of the calculated parameter ξ , and we find $\xi = (2.8 \pm 8.1) \times 10^{-3}$ for Cs-137. A simulation of the increased data that can hypothetically be expected following Mercury orbit insertion on 18 March 2011 suggests that the anticipated improvement in the determination of ξ could reveal a non-zero value of ξ if present at a level consistent with other data.

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