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Search of periodical and aperiodical variations of nucleus weak decay parameters

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On behalf of BSTU-PhIAN-INF collaboration

Possible temporal variations of nucleus decay parameters were studied extensively in the last years, their observation can be the signal of unknown physical effects. Several experiments reported the annual and daily decay rate oscillations in alpha and beta-decays of some radioactive nuclides at the level of .05 % [1,2]. Also, correlation of Mn-54 e-capture decay rate with electromagnetic solar activity was reported [1]. BSTU - PhIAN - INF collaboration studies decay rate variations in Co-60 β -decay and Fe-55 inverse β -decay (e-capture) isotopes. 1.3 MeV γ -quanta which accompanies Co-60 beta-decay were detected by cooled germanium semiconductor spectrometer. Fe-55 e-capture accompanied by X-ray with energy 5,9 or 6,4 KeV which in our set-up detected by cooled Si-Pin detector. Measurements of decay rate performed in 2016 -2021 , demonstrate that together with observed Fe-55 decay exponent with life-time 1004 days, oscillation period 29.5 +/- 1.5 days corresponding to moon month is found with amplitude (.22 +/- .04)% ; theoretical model of such decay rate deviations considered in [3,4]. Possible influence of electromagnetic solar activity was studied during 2015 – 2022 for Fe-55 decay rate, simultaneously with Co-60 decay rate in Novosibirsk INF at the distance 2800 km from Moscow [5]. The deviations of similar form and size from exponential decay law at the average level (.55 +/- .004)% were detected in both experiments during October- December 2018. Supposedly, they can be related to solar activity minimum started in the beginning of 2018 and continued till the end of 2020. In addition, ten decay rate dips of the order 1 % with duration from 50 to 208 hours were found. It is shown that such dips occur 48 – 80 hours before X-ray solar flare events with significant reliability, existence of such correlations can have important practical applications [5]. SOLARIS project plans to perform simultaneous measurements of Fe-55, Co-60 decay parameters at International Space Station and Earth labs. to study their correlations with electromagnetic solar activity, in particular, with X-ray solar flare events .

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