Contribution ID: **87** Type: **Oral talk (15 min + 5 min questions)**

THUNDERSTORM FLASHES AS THE MECHANISM OF 14C RADIOISOTOPE GENERATION

Tuesday, 12 July 2022 15:50 (20 minutes)

An atmospheric production of 14C radioisotope goes by the 14N(n,p)14C reaction under cosmogenic fluxes and this process is considered as the main source of radiocarbon creation which rate of accumulation is evaluated as ˜ 6.6 kg per year. An exclusively opportunities of dating based on the analysis of 14C concentration in the very old and ancient organic samples led to the discovery of short-term secular variation of radiocarbon in tree rings 1 and to the hypothesis of 14C generation under thunderstorms flashes. The nature of the lightning phenomena in fact is connected with the development of electron avalanche in the strong atmospheric electric fields (˜ 300 kV/m and more) 2. The very fast electron avalanche growth in the cloud electric fields ensures the phenomenon of terrestrial γ-ray bursts [2,3]. These energetic γ-rays generate the photonuclear reactions on atmospheric isotopes (with significant yield for hard photons E_γ = 20-60 MeV) as 14N(γ, n)13N, 16O(γ, n)15O, 40Ar(γ, n)39Ar. An increase of neutron flux causes the next series of (n, γ), (n,a), (n,p)-reaction and the 14N(n,p)14C is the top important for dating problem. For evaluating of the radiocarbon generation under thunderstorm conditions (and creation of another atmospheric isotopes too) it was proposed the model (realized in the spherical-layer geometry). The calculation were made at the several altitudes of the lower part of the atmosphere at the altitudes from 1 up to 15 km (covering the possible heights of detected lighting) [4,5]. Decrease of the atmospheric densities at increase of the altitude is critical for electron avalanche evolution and is included in the model. It was obtained the yield from thunderstorm 14C generation evaluated as 1e-4% relative to cosmogenic one. The results support the hypothesis that radiocarbon rise in the old tree rings (at AD 774–775) 1 can be explained by increased Sun activity of the Sun at this time interval.

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4. V. I. Lyashuk, Evaluation of Radiocarbon 14C Yield Under Conditions of Thunderstorms, Geophysical Research Letters, 48, e2021GL095357. https://doi.org/10.1029/2021GL095357
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The speaker is a student or young scientist

No

Section

1. Experimental and theoretical studies of nuclear reactions

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