



Space Alpha Particle Fluxes towards the Earth's Surface Increase Human Mortality – Examples from the Balkans and Greece

Takuchev N*

Trakia University, Bulgaria

***Corresponding author:** Nikolay Takuchev, Ph.D., Associate professor, Trakia University, Stara Zagora, Bulgaria, Tel: +359 888439122; Email: nnnpppttt@gmail.com

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Abstract

A dangerous phenomenon for humanity is described. In the joint analysis of data from satellites in orbit around the Earth and from the health statistics source EUROSTAT, it became clear that, by some mechanism, flows of positively charged particles with high energy entering the Earth's orbit increase mortality on the planet's surface. The increase in mortality from the most deadly group of diseases for humanity – circulatory system diseases is by an average of 5% to 15% in a zone of maximum risk in the Northern Hemisphere, parallel to the equator and bounded by the parallels of 30° and 50° north latitude. Examples are given for the Balkans and Greece confirming the described phenomenon. A hypothetical mechanism based on observational evidence has been proposed, according to which this dangerous phenomenon is due to solar alpha particles of high energy sufficient to overcome the resistance of the atmosphere and reach the Earth's surface in a limited area of maximum death impact.

Keywords: Mortality; Circulatory System Diseases; Satellites GOES; Cosmic Alpha Radiation

Abbreviations: WHO: World Health Organization; IHD: Ischemic Heart Disease; ICD: International Disease Classifier; SMS: Synchronous Meteorological Satellites; GOES: Geostationary Operational Environmental Satellites; EPS: Energetic Particles Sensor; AMS: Alpha Magnetic Spectrometer; NUTS: Nomenclature Des Unités Territoriales Statistiques; EPEAD: Energetic Proton Electron and Alpha Detector.

Introduction

In a series of publications [1-13], a dangerous phenomenon of cosmic origin for humanity was described – the presence of a high correlation between the flows of positively charged particles with high kinetic energy recorded from satellites in the Earth orbit and mortality on the Earth's surface from some diseases, mainly of circulatory

system – the humanity killer number one. According to statistics from the World Health Organization (WHO), ischemic heart disease (IHD) mortality, the main share of circulatory system mortality, is at the top of the list of morbid causes of death on the planet [14]. According to WHO data, 8.9 million people died worldwide from IHD in pre-pandemic 2019 [15]. According to Khan M, et al. [16] the morbidity and mortality of IHD are not spread evenly across the planet. The highest mortality from IHD is in a region including Central and Eastern Europe.

The mentioned dangerous phenomenon of cosmic origin is noticeable (i.e. there is a statistically significant correlation) for several small countries in Central and Eastern Europe and the Mediterranean – in the data for Bulgaria, Greece, Romania, Austria, Hungary, South Italy, Sicily, Malta, and Balearic Islands. However, in Takuchev N [1-

[13] are described many examples, where this phenomenon is also observable in several countries from the Northern Hemisphere – Asia, America, and even Africa. In the affected countries, the phenomenon leads to an increase in circulatory diseases mortality. In separate years in the Mediterranean countries, the increase in IHD mortality reached up to 40% [4,10]. Below are more examples from a study of the effects of space alpha radiation on the inhabitants of the Balkans and particularly Greece.

Countries, where circulatory diseases mortality is most strongly correlated with high- energy positively charged particle fluxes, are located in a zone parallel to the Equator with approximate limits between 30° and 50°N latitude. The described phenomenon is not observed in countries located near the North Pole. It is also not observed in the statistical data of large countries such as the USA, Russia, and China, which are also located in the mentioned area. This (at least for the USA) [10] is due to masking of the phenomenon in the general statistics for the large country if the cause acts on a limited area smaller than the country and for a limited time – lasting much less than data averaging periods for statistical purposes. This phenomenon would be expected to influence mortality in countries south of the Equator, but mortality statistics for them are scarce, unreliable, or absent, preventing reliable inferences about such an influence in the Southern Hemisphere.

Material and Methods

Mortality Data

The analysis below is based on an authoritative source of health data – EUROSTAT [17]. In the study, the parameter annual mortality rate – number of deaths per 100,000 inhabitants was used as a characteristic of mortality. Eurostat offers free access to data on mortality rate from causes in the countries of the European Union, the European Economic Area, and the candidate countries for membership in the union. Geographically, these countries occupy Europe and the Mediterranean. Data are grouped by NUTS (Nomenclature Des Unités Territoriales Statistiques in French, the nomenclature of territorial units for statistics). In the study, were used mortality data from the Eurostat shortlist in which mortality rates are grouped by causes of death into 88 groups, mostly diseases. The groups are related to the classes in the International Disease Classifier ICD-10, (10th revision). The shortlist contains mortality data for EU countries (NUTS-1) and EU regions (NUTS-2, smaller areas of the larger NUTS-1 countries). Currently (2023) the shortlist includes mortality rate data for the interval 2011 – 2020. Annual mortality rate data were extracted for 37 European countries (NUTS-1) and 57 European regions (NUTS-2) separately from each of the shortlist groups for the interval

2011– 2019 (the last pre-pandemic year).

Satellites Data

Satellite data on corpuscular radiation – protons and alpha particles recorded by the satellites of the two series SMS (Synchronous Meteorological Satellites) and GOES (Geostationary Operational Environmental Satellites) were obtained from an NOAA site [18]. The satellites of the SMS and GOES series fly in geostationary orbit (above the Earth's equator), at an altitude of 36,000 kilometers above the Earth's surface, make one lap in 24 hours, that is, they “hang” over a certain point on the Earth's surface and are not shade by the Earth at their circumference around it.

Data on alpha-particle and proton fluxes (unit: (number of particles). $\text{cm}^{-2} \cdot \text{s}^{-1} \cdot \text{sr}^{-1} \cdot \text{MeV}^{-1}$) with energies of the range 3.8–21.3 MeV were used. The fluxes were recorded by the satellite high-energy particle detectors: 1. Energetic Particles Sensor (EPS), and 2. Energetic Proton, Electron, and Alpha Detector (EPEAD). The data are available averaged over a 5-minute interval, during which there are up to 25 reports of the instrument.

Data Processing

The correlation coefficients [19] between the annual averaged alpha radiation flux and the annual mortality rate were calculated.

Maps were created showing (with black isolines) the distribution of the annual mortality for European regions from each of the studied Eurostat shortlist groups of death causes for 2012, the year with the highest mortality in the time interval 2011-2019 [17] across the territory of Europe and the Mediterranean. With red isolines, the maps show the distribution across the territory of Europe and the Mediterranean of the correlation coefficient between the annual mortality rates from each of the studied shortlist groups with the annually averaged alpha particle flux for the period 2011 - 2019. Data on the coordinates, latitude, and longitude [Google Earth] of the centroids of the regions included in the study were used in the maps. Mapping was performed with Golden Software Surfer10. The kriging interpolation procedure was selected.

In mathematical statistics, the level of statistical significance [19] is a parameter, indicating the degree of reliability of the calculated correlation coefficient. The smaller the number of this parameter, the more reliably the correlation coefficient is established, i.e. the more reliably a cause-and-effect relationship has been established, in the case between the annual flux of alpha radiation and mortality from causes in the shortlist.

The correlation coefficient and the level of statistical significance are related. For the 9 years included in the study, a minimum correlation coefficient of 0.668 corresponds to a statistical significance level of 0.05, a minimum correlation coefficient of 0.798 corresponds to a statistical significance level of 0.01, and a minimum correlation coefficient of 0.899 corresponds to a statistical significance level of 0.001 [19].

In scientific studies, a level of statistical significance no greater than 0.05 is accepted as a criterion for the reliability of the correlation coefficient. The isolines on the correlation coefficient distribution in the maps enclose the regions with statistically significant values of the correlation coefficients around and up to a significance level of 0.05. Correlation coefficients with a significance level above 0.05 are of high reliability (the higher the number, the lower the significance level) i.e. the existence of a causal relationship between cosmic alpha radiation and mortality from the shortlist causes can be considered reliably established in the mentioned areas enclosed by isolines on the correlation coefficient.

If for a given shortlist, group causes there is a coincidence for some of the maxima for mortality rate and correlation coefficients, then in the region of these maxima, the impact of alpha radiation contributes noticeably to the mortality from this group.

For each shortlisted group separately the significant correlation coefficients were grouped into three groups according to their level of significance, mentioned above. The index of the influence between alpha particle fluxes and the mortality rate was calculated as a weighted sum of the number of the group significant coefficients in each of the three groups, with weighted coefficients 1 for the significance level of 0.05, 2 for the significance level of 0.01, and 3 for the significance level of 0.001. All shortlist group causes were sorted by their index in descending order.

To the extent that the hypothetical mechanism proposed below explaining the observed phenomenon assumes that charged particles of high energy pass through the atmosphere and reach the Earth's surface, the energy required for this was calculated from databases and calculators PSTAR and ASTAR [20,21]. Geomagnetic field data were obtained from the INTERMAGNET site [22].

Results

The described dangerous phenomenon is observed in the form of dependence between the annual average flux of radiation from positively charged particles with high kinetic energy, recorded by satellites in orbit around the Earth, and

the annual mortality rate from the several shortlist groups in the statistics of several countries from all continents in the Northern Hemisphere. The countries in whose circulatory system mortality statistics the phenomenon is observed are located in a zone parallel to the equator with approximate boundaries along the parallels of 30° and 50° north latitude. It is observed in the annual mortality statistics of small countries. It is not noticeable in the statistics of large countries in the same zone. It can be inferred that the impact on the Earth's surface is short-lived and over a limited area the size of a small country, but is masked in large country statistics because it does not affect the entire area of the large country at the same time. This conclusion is confirmed for the USA, for which there is data on mortality in individual states [10].

For particle energies of the order of 3.8–21.3 MeV, the year-averaged fluxes of protons and alpha particles are highly correlated, i.e. the studied phenomenon of lethality is noticeable in both the mean proton flux and the mean alpha particle flux data. In the examples below an averaged stream of high-energy alpha particles is included as the incident radiation.

Space Alpha Particle Fluxes Mainly Affect The Circulatory System

The first 5 out of 88 shortlist death causes for Europe and the Mediterranean sorted by their index of the influence of alpha particle fluxes on the mortality rate are shown in Table 1.

Eurostat shortlist of mortality causes and their codes in ICD-10	Index, 0 - 9
Diseases of the circulatory system (I00-I99)	9
Cerebrovascular diseases (I60-I69)	9
Intentional self-harm (X60-X84, Y87)	8
Other ischemic heart diseases (I20, I23-I25)	7
Ischemic heart diseases (I20-I25)	6

Table 1: Eurostat Shortlist of Mortality Causes and their Codes in ICD-10 sorted by their Index of the Influence of Alpha Particle Fluxes on the Mortality Rate.

Figure 1 shows the time dependence in the interval 2011 – 2019 of two numerical sequences:

- Of the recorded annual fluxes of alpha particles from satellites of the GOES series – 13, 14, and 15, and of the annual mortality rate of Diseases of the circulatory system (I00-I99) for the Aegean Islands and Crete, Greece, East Mediterranean.

- The high correlation between the two numerical sequences can be seen, indicating the existence of a causal relationship between them.

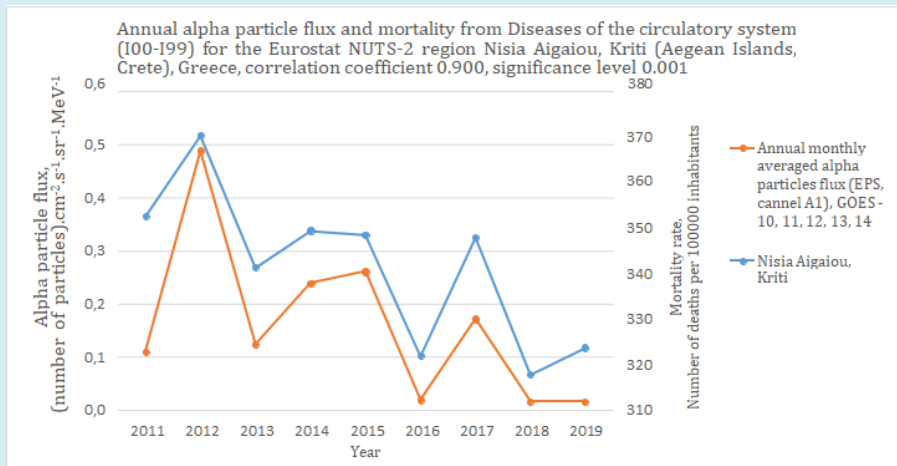


Figure 1: The High Statistically Significant Correlation between Annual Fluxes of Cosmic Alpha Radiation And Diseases of the Circulatory System (I00-I99) Mortality Rate for the Aegean Islands and Crete, Greece, East Mediterranean, Indicates The Presence of a Causal Relationship Between the Two Phenomena.

Figure 2 shows the distribution of mortality rate from Diseases of the circulatory system (codes I00-I99 from ICD-10) for the Balkans and the North-East Mediterranean. There is no Eurostat mortality data in the territories of the Balkans, shown in a darker background. In the Central Balkans, there is an area of multicenter maximum mortality rate, overlapping with the areas with maxima of moderate correlation between annual cosmic alpha radiation flux and the mortality rate

of circulatory system diseases. The overlapping means a noticeable impact and casual relationship between space alpha particle flux and this mortality rate. The pronounced effect – the highest correlation between alpha particle fluxes and the mortality rate is observed for the islands in the Aegean basin See Figure 1, but the mortality rate in the area is less than in the Central Balkans.

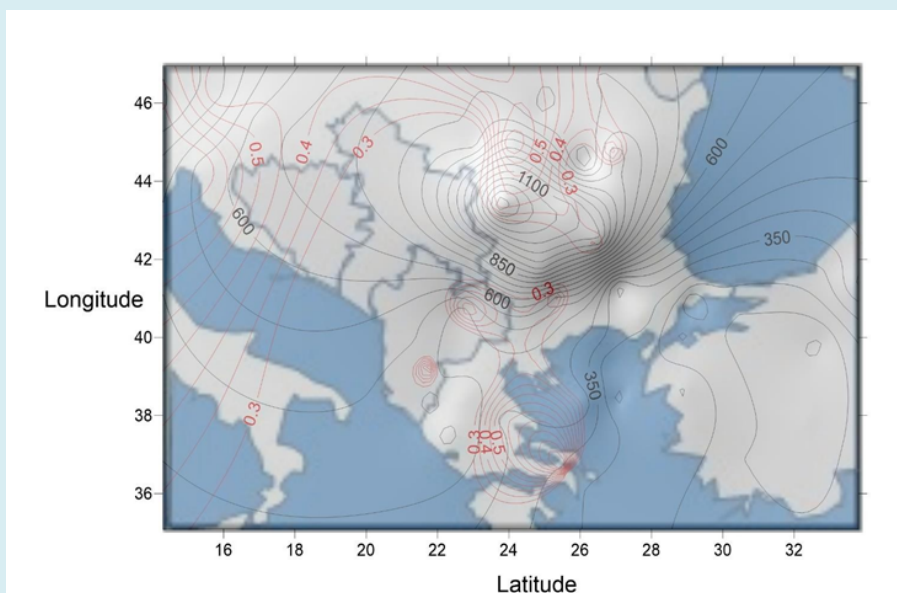


Figure 2: Balkans, the Mortality Rate (Black Isolines) from Diseases of the Circulatory System (I00-I99) and its Correlation with Annual Alpha Particle Flux (Red Isolines).

Figure 3 shows the correlated time variation of cosmic alpha radiation and mortality from the shortlist group of causes of Cerebrovascular diseases (ICD-10, codes (I60-I69)), with index 9 (second position in Table 1). The example shows the existence of a causal relationship between the flow of cosmic alpha radiation and cerebrovascular diseases

mortality in Greece.

In absolute terms, the death rate is not high, but there is a pronounced effect – causal relationship with cosmic alpha radiation.

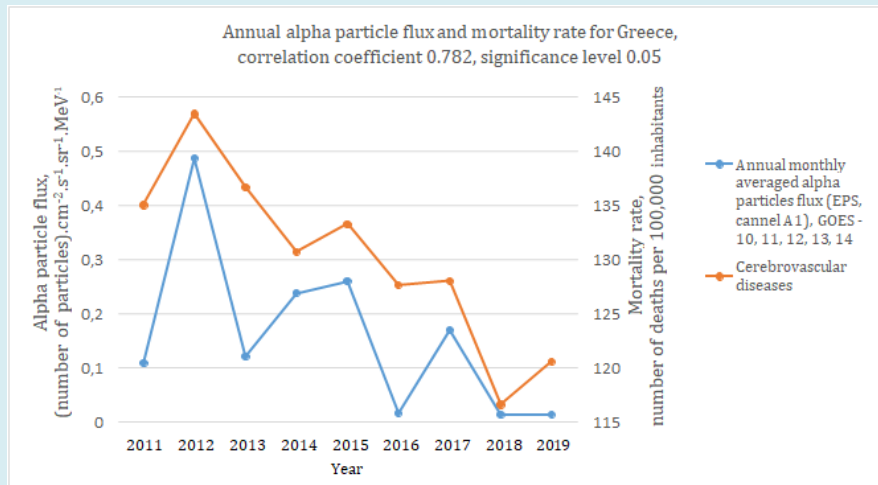


Figure 3: Between the Mortality Rate from Cerebrovascular Diseases (ICD-10, Codes (I60-I69)) in Greece and the Annual Alpha Particle Flux Reaching Earth's Orbit, there is a Large, Statistically Significant Correlation.

Figure 4 shows the distribution of mortality due to Cerebrovascular diseases (ICD-10, codes (I60-I69)), for the Balkans and particularly for Greece. Areas of increased mortality coincided with those with statistically significant correlation coefficients of the dependency between mortality and cosmic alpha radiation for the Central Balkans,

indicating the presence of an influence of alpha radiation on cerebrovascular mortality. In the South Balkans (Greece) the mortality is less. Still, the correlation with the annual alpha particle flux reaching Earth's orbit is larger for Greece – a bigger part of the mortality is alpha particle stream dependent.

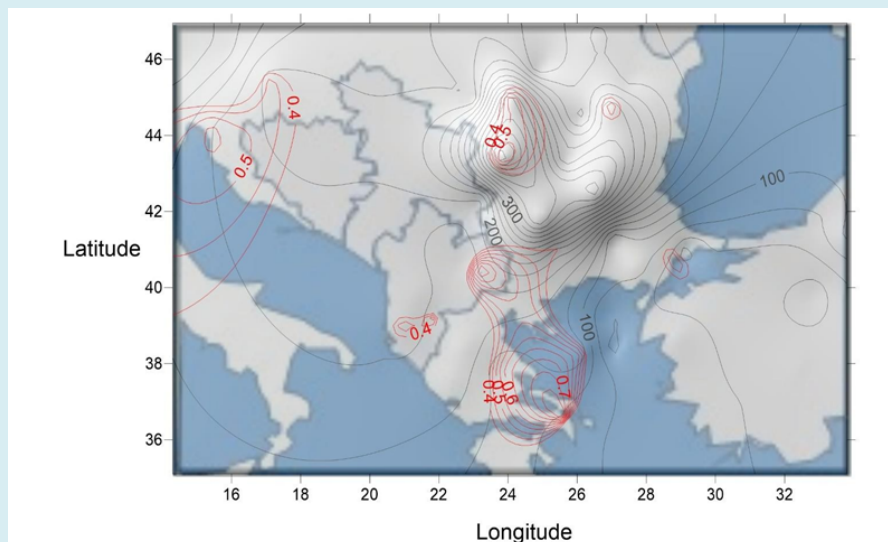


Figure 4: Between Mortality from Cerebrovascular Diseases (Icd-10, Codes (I60-I69)) for Balkans and Greece (Black Isolines) and the Annual Alpha Particles Flux Reaching Earth's Orbit, there is a Large, Statistically Significant Correlation (Red Isolines).

Hypothetical Mechanism of the Described Phenomenon

- An observed phenomenon – in the statistics of several countries located mainly in the 30°N – 50°N band, mortality from certain diseases, mainly those of the circulatory system, is strongly correlated with flows of positively charged particles with energy of the order of 4 – 21 MeV, recorded by the SMS and GOES series satellites in Earth orbit.
- The recorded alpha particle flows are mostly pulses with a duration of less than 5 minutes (the averaging interval of the recording device).
- Proposed hypothesis – positively charged particles with high energy penetrate through the Earth's atmosphere to the Earth's surface and damage human health, to the greatest extent the human circulatory system, causing death mainly in elderly people with an already damaged circulatory system.
- As the average altitude of the affected countries increases, the particle flux- correlated mortality from cardiovascular diseases shows an increasing trend [4,10]. It is probably due to the more intense radiation flux penetrating the thinner atmosphere over the mountainous region of Earth's surface – an argument favoring the hypothesis.
- The source of the flows of positively charged particles is the Sun – mortality increases with observable processes on the Sun – from SME directed to Earth (a phenomenon on the solar surface that could be observed with other astronomical means) [4,8]. The Alpha Magnetic Spectrometer (AMS-02) on the International Space Station measures cosmic rays, excluding those of solar origin (when shielded from the Sun by the station's solar panels). In particular, it measures the flow of ^3He and ^4He (alpha particles) in cosmic rays. The measurements show [23] increasing annual flux of alpha particles in cosmic rays for the interval of years from 2011 to 2017 (last available data), while the flux of GOES registered (solar?) alpha particles for the same interval of years is decreasing (Figures 1 and 3). Indirect evidence for the Sun as a source of high-energy alpha particles is that this assumption convincingly explains the downstream processes that ultimately lead to death from the circulatory system diseases.
- Positively charged solar particles capable of penetrating through the Earth's atmosphere to the Earth's surface are high-energy alpha particles. Calculators PSTAR [20] and ASTAR [21] calculate the penetration parameters of protons, respectively alpha particles in different substances, in particular in air. Calculations with data for a homogeneous atmosphere – an atmospheric model with constant density, temperature, and pressure decreasing with height [4] show that only particles whose energy is above 2.4 GeV for protons and over 6.2 GeV for alpha particles can penetrate the Earth's atmosphere to the surface. There are no registered protons above 0.7 GeV, but there are registered alpha particles with energy above 3.4 GeV, hypothetically also those with energy above 6.2 GeV [4,10,12], i.e. the particles that penetrate to the Earth's surface are probably high-energy alpha particles. Only flows of alpha particles with a magnitude of at least (1000 particles). $\text{cm}^{-2}\cdot\text{s}^{-1}\cdot\text{MeV}^{-1}$ is correlated with the mortality of the Earth's surface.
- It is assumed that the alpha particles recorded by the satellites were emitted simultaneously in a common explosive process on the solar surface with the hypothetical fast alpha particles. It can be calculated that particles with an energy of 7 GeV need 8.87 min to reach the Earth's surface from the Sun's surface, and registered particles with energies of 5 – 10 MeV travel about 2 hours. The recorded alpha particles do not have enough energy to penetrate the atmosphere, unlike the hypothetical fast alpha particles that reach the surface of the Earth in minutes from the center of the solar disk. However, the recorded alpha particles are an indicator that two hours earlier there was an irradiation of the Earth's surface with fast alpha particles.
- Although alpha particle streams irradiate the entire illuminated part of the atmosphere, penetration of fast alpha particles to the surface occurs only in a limited area of the surface (death spot), for which two conditions favoring penetration are combined:
 - The Sun is culminating for the center of the death spot,
 - For the center of the death spot, a coincidence is in effect – the direction of the geomagnetic vector coincides with the direction of the alpha particle intrusion – the alpha particle movement is not affected by the deflecting magnetic force. Such a coincidence occurs twice a year for latitudes in the band from 28°N to 48°N [4]. For latitudes outside this band, such a coincidence is impossible, the fast alpha particles do not reach the Earth's surface, which explains why for countries located near the North Pole no correlation is observed between alpha radiation fluxes and mortality from circulatory system diseases.
- From the data for the hours and minutes of registration of the alpha particle flow, the longitude can be determined, and from the date – the latitude of a point on the Earth's surface where the solar disk is at its culmination at that moment – the point of registration. The center of the dead spot can be calculated – it is approximately 30° east of the registration point [10]. The Earth's angular velocity is 15° per hour.

Discussion

The moment of occurrence of a flow of fast alpha particles cannot be predicted, but the dates of increased risk for a given point on the Earth's surface between 30°N – 50°N can be calculated by the latitude of the location. For example, for the islands in the Aegean basin See Figure 1, with latitude 37°N, the dates with maximum risk are March 17 and September 27 [10]. The increased risk of a circulatory system incident outdoors around local noon is a further argument for the healthfulness of the indoor midday break ('siesta') practiced in Mediterranean countries.

The predominant part of the recorded pulses of alpha particles form unnatural series with fixed periods and relatively constant magnitudes, which allows the hypothesis of their artificial origin [12].

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