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## The High-Energy Positive Solar Particles Invading Earth with Contribution to the Mortality from Ischemic Heart Diseases?

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*Introduction:* According to the results from several studies [for example 1,2] high-energy positive solar particles fluxes, invading Earth are correlated with mortality from ischemic heart diseases, Ischemic heart diseases, according World Health Organization (WHO) statistics [3], are the first in the list of the 10 most frequent causes of death in 2016, regardless of the state's economic situation.

*Objective.* A possible mechanism of the observed phenomenon is discussed. An example of the short-term impact of high-energy alpha fluxes on the area of USA, affecting the short-term female mortality in the region, is explained by the proposed mechanism.

*Material and Methods:* Data on solar corpuscular radiation was obtained from an NOAA site – from the Geostationary Operational Environmental Satellite series (GOES). High-energy protons and alpha particles' path length through the atmosphere and corresponding energy were calculated by PSTAR and ASTAR databases and calculators. Data for mortality of ischemic heart diseases in the interval 1974 – 2019 from reliable statistical source – Centers for Disease Control and Prevention USA, were used.

*Results:* Between the annual fluxes of protons and alpha particles on the one side and the male and female ischemic diseases mortality in several states in USA, on the other side, a high statistically significant correlation was found.

*Discussion:* A hypothetical mechanism is proposed [2], explaining the observable data. According to this mechanism, positively charged high-energy solar particles penetrate the atmosphere to the Earth's surface, reaching relatively small areas (spots) with typical dimensions of hundreds of kilometers, where they affect the biosphere. The spots are places, where the directions of geomagnetic field induction and the direction of the invasion of particles in the atmosphere are parallel – no deflecting force acts in this case to the charged particles. The energy required for the particles to overcome the interaction with the particles in the atmosphere was estimated. The particles reach the Earth's orbit for minutes, and penetrate the atmosphere in its thinnest part – the places where the Sun is at its culmination at the time of the arrival of particles. The described mechanism allows calculation of the width of the zone of latitudes with the most intensive impact – mainly between 28°N and 48°N. The mechanism allows calculating the dates with increased risk depending on latitude on the Earth's surface. According to satellite observational data (GOES 13), a significant flux of alpha particles with energies above 3.4 GeV is observed in geostationary orbit, while the proton flux with energies above 0.7 GeV is hundreds of times weaker. This makes it more likely to conclude that high-energy alpha particles reach the Earth's surface and cause death.

### References

1. Most Common Causes of Death. Available: <http://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>, last visited on 14.8.2018.
2. Takuchev N 2019 Solar corpuscular radiation and mortality from various forms of ischemic heart disease in Bulgaria for the interval 2005 - 2015. AIP Conference Proceedings 2075, 130005; 13005-1 - 13005-6; Available: <https://doi.org/10.1063/1.5091290>
3. Takuchev N 2021 Does the Angel of Death Sometimes Use Solar Alpha Particles to Take Our Souls? BP International ISBN 978-93-91215-44-6 (eBook) DOI: 10.9734/bpi/mono/978-93-91215-36-1.

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