

Influence of the around-object environment on orbital space vehicles

L. M. Vasilyak¹, E. V. Shubralova² and V. N. Chikirev²

¹ Joint Institute for High Temperatures of Russian Academy of Sciences

Bd. 2, 13 Izhorskaya st., Moscow, 125412, Russia

² Joint Stock Company "Central Research Institute for Machine Building"

4 Pionerskaya st., Korolev, Moscow Region, 141070, Russia

Received 23.09.2024; revised 6.11.2024; accepted 18.11.2024

The analysis of studies of the luminescence of meteor shower particles recorded in the international space experiments "UV-atmosphere" since 2019 and "Terminator" on the international space station has been performed. The analysis showed that the number of recorded cases of meteor luminescence in the UV region of the spectrum in the atmosphere exceeds the estimated zenith hourly number of events that an observer on Earth would have seen. This difference may be due to the more accurate registration of small particles, the faint glow of which is not visible from the surface of the Earth against the background of noise. Aerosol layered structures were found in the upper layers of the atmosphere during the passage of meteors at altitudes of 90–100 km, as a result of the continuous influx of microparticles from meteor showers during the epoch. When high-speed particles of meteor showers strike the surface of a space object, pulsed plasma, pulsed electric and magnetic fields, and electric current pulses occur, which affect spacecraft and can lead to destructive effects on electronics and computer programs, which can lead to equipment failure.

Keywords: international space station; meteor showers; layered atmospheric structures; high-speed particles.

REFERENCES

1. Klimov P. A., Bulletin Russian Academy of Sciences: Physics **85** (4), 389 (2021).
2. Casolino M., Barghini D., Battisti M. et al., Remote Sensing of Environment **284**, 113336 (2023).
3. Bacholle S., Barrillon P., Battisti M. et al., Astrophysical Journal, Supplement Series **253** (2), 36 (2021).
4. Belyaev A. N., Nikolaishvili S. S., Omel'chenko A. N., Repin A. Yu., Poluarshinov M. A., Smirnov Yu. V., Strakhov A. V., Batishchev A. G., Stasevich V. I. and Platonov Yu. V., Geomagnetism and Aeronomy **63**, 409–420 (2023). <https://doi.org/10.1134/S0016793223600248>
5. Belyaev A. N., Izvestiya. Atmospheric and Oceanic Physics **58** (3), 344–351 (2022) [in Russian].
6. Avanesov G. A. and Moroz V. I., Science and humanity, Moscow, Znanie, 1988.
7. Ponomarev G. P., Pavlyukov V. K., Abdurakhmanov A. I., Rybin A. V. and Borodina O. S. Materials of the conference dedicated to the Day of volcanologist. Petropavlovsk-Kamchatsky, March 27–29, 2008. Petropavlovsk-Kamchatsky: IVIS FEB RAS, 2008 [in Russian].
8. Ponomarev G. P., Rashidov V. A., Chuburkov Yu. T. et al. Materials of the All-Russian meeting "Geodynamics, magmatism and minerageny of the continental margins of the Northern Pacific". Magadan, **2**, 200–201 (2003) [in Russian].
9. Marchenko A. G., Volfson A. A., Morozov M. V. et al., Geology of Ore Deposits **62**, 122–137 (2020). <https://doi.org/10.1134/S1075701520020038>
10. Deshevaya E. A., Shubralova E. V., Fialkina S. V., Guridov A. A., Novikova N. D., Tsygankov O. S., Lianko P. S., Orlov O. I., Morzunov S. P., Rizvanov A. A. and Nikolaeva I. V., BioNanoScience **10**, 81–88 (2020). doi: 10.1007/s12668-019-00712-1
11. Zinivovskaia I., Grozdov D., Yushin N., Safonov A., Proshin I., Volkov M., Pryadka A., Belyaev V., Shubralova E. and Tsygankov O., Acta Astronautica **189**, 278–282 (2021).
12. Tsygankov O. S., Polyot, № 1-2, 16–24 (2023) [in Russian].
13. Voronov K. E., Telegin A. M., Piyakov A. V. and Ryazanov D. M., Usp. Prikl. Fiz. (Advances in Applied Physics) **8** (1), 3–20 (2020) [in Russian].
14. Cooke W. J. The 2009 Perseid Meteoroid Environment and Landsat 5. NASA MEO Internal Report, NASA Marshall Space Flight Center in Huntsville, Ala., 2009.
15. McDonnell J., McBride N. and Green S. Near Earth environment, in Interplanetary Dust / Eds. Grün E., Gustafson B. A. S., Dermontt S. F., Springer, New York, N.Y., 2001, pp. 161–231.
16. Kelley M. C., Pancoast S., Close S. and Wang Zh., Advances in Space Research **49** (6), 1029 (2012).