

INSTRUMENTS, METHODS AND NETWORKS OF OPTICAL AURORAL OBSERVATIONS IN ARCTIC

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The report devoted mostly to the Russian instrumental optical observations, which were carried out in Arctic and Antarctic regions in last years. In this report, we describe typical examples of natural aurora and airglow events, exhaust products of rocket technique and man-made aurora. We discuss their common features, appearance, visual properties and physical mechanisms. Many years routine ground-based all-sky cameras, spectrographs and, later, low-light TV and CCD all-sky cameras were used to collect data for these artificial “auroral” phenomena. A number of interesting pictures have been collected by amateurs and analyzed, as unusual atmospheric phenomena too. Polar Geophysical Institute (PGI) was a leading organization on investigation of optical aurora [1] and because of that had a plenty of observation places. PGI also was responsible for observation of so called “Abnormal Atmospheric Phenomena” - AAP in the polar regions of Russia in frame of programs “Setka” and “Galactika”. International archive ICD B-2 with thousands meters of films with atmospheric optical phenomena at numerical stations in Arctic and Antarctic is in the PGI too. The report contains detail information about construction and parameters of the automatic all-sky camera C-180, which have been used in a patrol way during the International Geophysical Year (1957-1958) at more than 40 Russian stations. From this camera data the “Auroral oval” was discovered and numeric measurements of aurora heights by triangle methods were produced. Spectral all-sky camera C-180-S was installed at 6 stations and successfully was used for aurora spectrum observation. These kind observations were continued up to “perestroika” by several devices in PGI in Barents region. Observations and study of the AAP by these cameras allow collecting information on anthropogenic pollution of the near-Earth space and recognize a lot of AAF. A part of such observations were a sub-product of rocket launches from the Plesetsk rocket range and Belye/Barents sea naval range area. Optical phenomena were always under routine monitoring by the auroral all-sky cameras from Northern Scandinavia and the Kola Peninsula during several decades. A number of observations of such effects have been carried out in the northern Russia and they have been published mostly in Russian. Due to this fact, they are hardly available for international science community. From other side the opportunity to see bright luminosity clouds caused by the exhaust products or active experiments in space have frequently resulted in sensational messages in the mass media about an appearance of an Unidentified Flying Object, UFO. For example, so called the “Petrozavodsk Miracle” was under numerous discussions in Russian, European and USA mass-media as a real UFO event. In reality it was a result of Russian “Cosmos-955” launch from the Plesetsk range early morning of September 20, 1977. Launches of rockets from Russian rocket ranges and launches in numerous geophysical experiments in USA, Europe and Russia are accompanied by injections of different chemical components, such as Al, Ba, Be, Li, Na, Sr, Mg, Be, LiH, LiClO₄ and (AlH₃)₃ into the upper atmosphere. They can be registered by ground-based equipment and could be distinguished from AAF and UFO (if they exist) by spectral methods, scales and temporal and space development of events. Examples of this analysis are presented in the work [1] and in this report,

Modern optical study of Aurora in PGI continues at Apatity station and Lovozero observatory (Kola Peninsula) and at Barentsburg station (Spitsbergen) by new equipment. There are all-sky camera and spectrographs used CCD detectors and hyperspectral camera designed in frame of Norwegian-Russian grant in the project “NORUSKA” [2]. Author thanks to RFBR grant #14-05-98820.

1. S.I. Isaev. Morphology of aurora. *Monography.Nauka, Leningrad*, 1968, 167 p.
2. S.A Chernouss, Yu.V. Platov, V.V. Alpatov and M.V.Uspensky. Optical Phenomena due to Rocket Exhaust Products in the Atmosphere. *Geophysica* (2012), 48(1–2), 65–79
3. F. Sigernes, Yu. Ivanov, S. Chernouss, et al. Hyperspectral all-sky imaging of auroras. *Optics Express*, Vol. 20, Issue 25, pp. 27650-27660 (2012).<http://dx.doi.org/10.1364/OE.20.027650>.

