To the radiative transfer theory in medium

A. Pevzner and A. Sokolovsky

*Dnipropetrovsk National University, Department of Theoretical Physics, 72
Gagarina Ave., 49010 Dnipropetrovsk, Ukraine,
E–mail: pevzner@ffeks.dnulive.dp.ua*

The present work is devoted to investigation of some questions of the radiative transfer theory. Two kinds of problems seem to be actual in this theory nowadays.

The solution of problems of the first kind is very important for obtaining any results. As known, the radiative transfer equation in a classical phenomenological theory can be solved formally but the obtained expression is an integro-differential equation in-turn. In the majority of cases it cannot be solved analytically and we should search for some approximate methods of its solving. In the present work Ambartsumian's approximate method [1] is considered. We have applied it to calculation of the brightness distribution of the day sky of a planet assuming that the Rayleigh scattering takes place in its atmosphere and that this atmosphere is plane-parallel. *The first approximation is obtained and verified how well it corresponds to the initial equation using computer numerical methods.* It is shown that qualitatively this approximation is in a complete agreement with an exact solution. The main sources of errors and the ways to remove them are described.

The second kind of problems is more fundamental then the first one. The scattering atmosphere can be characterized by its macroscopical parameters (such as indicatrix $p(\theta, \theta')$, absorption coefficient κ_ν, source function Ξ_ν etc.) and microscopical ones (such as distribution functions $f_p^{\alpha\alpha'}(x, t)$, survival capability λ of the quanta etc.). Connecting these parameters is an actual problem. We show that *the radiative transfer equation can be obtained from kinetic equation for photons in medium* derived in [2,3]. To this end definition of parameters which completely describe the transfer taking into account polarization phenomena (a generalized specific intensity) is discussed.

[1] V.A. Ambartsumian. $http://ambartsumian.ru/dvd/$
$/Publications/Papers/1941UchZLGU_164A.pdf$.

[2] A.I. Akhiezer, S.V. Peletminsky, Doklady AN SSSR, 200, 1317 (1971) (in Russian).

[3] A.S. Kompaneets, ZhETF, 31, 876 (1956) (in Russian).