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Theory of weak spactral lines formation within a plane-parallel atmosphere bounded from below by a reflecting underlying surface

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Making use of the multiple light scattering theory in an uniform atmospheric slab of final optical thickness $\tau 0$ bounded from below by arbitrary reflecting bottom, the analytical formation theory of weak spectral lines has been performed. Considering formation of such lines within a system “atmosphere – underlying surface” under conditions of almost pure scattering ($1 - \Lambda \ll 1$) and ($\tau^0 < 1$, $\tau_\nu^0 < 1$), the exact analytical expressions for absorption profiles of weak spectral lines have been obtained. Having made use the applied point of view, models of orthotropic and mirror reflection for underlying surfaces are considered. Separately, the important case of extremely stretched (near small scattering angles) atmospheric phase function has been studied. It’s been also demonstrated here that relation between initial optical parameters of the optical system mentioned above (atmospheric phase function - optical thickness - reflection low of underlying surface) is significant for the final results of appropriate imitative theoretical modeling. In present paper are exposed the results which allow to generate the theory of weak spectral lines formation applied for the atmospheric slab bounded from below by Lambertian’s reflecting bottom, having been developed earlier by Victor V. Sobolev [1]. It should be stressed that above mentioned problem for the case of a semi-infinite planetary atmosphere has been studied making use of multiple light scattering theory in [2].

References

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2. Anikonov A. S., Smokty O. I. Light Scattering in the Large Optical Thickness Media, St. Petersburg, Publ. Co. Nauka, 2008, 440p.