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Radiation on Conducting Sphere and Hemispherical Bulge in Conducting Plane: Further Development

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The description of diffraction and transition radiation (DR and TR) on a metal sphere based on the method of images known in electrostatics (see, e.g., [1]) has been developed in [2]. In the method of images the boundary conditions for the field of the incident particle on the perfect conductor surface are satisfied via introduction of one or more fictitious charges (the "images"of the real one). The uniform motion of the incident charge near the conducting sphere leads to the accelerated motion of its image that produces the radiation. This approach had been expanded in the paper [3] to the problem of DR by the particle moving parallel to the conducting plane with the hemispherical bulge on it. This problem requires introduction of three fictitious charges two of which move with acceleration.

The present report contains the further consideration of the problem including:

(i) Exact formulae for the polarization of DR both on the spehere and hemisphere in the long-wavelength limit ($\lambda \gg R$). The possibility of the projectile's trajectory monitoring via the polarization of DR on the sphere is demonstrated.

(ii) Computation of TR intensity on the hemispheric bulge. The complex character of the interference leads to a large variety in TR directional diagram shapes.

(iii) Numerical computation of the radiation from the bunch of charged particles on the sphere as well as on the hemispheric bulge.

References

[1] J.D. Jackson, Classical Electrodynamics, Wiley, New York, 1999.

[2] N.F. Shul'ga, V.V. Syshchenko and E.A. Larikova, Nucl. Instrum. Methods B 402 (2017) 167.

[3] V.V. Syshchenko, E.A. Larikova and Yu.P. Gladkih, JINST 12 (2017) C12057.

Primary author: Prof. SHUL'GA, Nikolai (Akhiezer Institute for Theoretical Physics of NSC KIPT)

Co-author: Prof. SYSHCHENKO, Vladislav (Belgorod State University)

Presenter: Prof. SYSHCHENKO, Vladislav (Belgorod State University)

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