*Workshop on "Recent advancements in remote sensing and modeling of aerosols, clouds and surfaces",*
*GRASP ACE Summer school,*
*Lille, France, May 22-26, 2023*

# The opposition effects of Solar System bodies: characteristics and simulation

**Tishkovets Victor[a*] and Berdina Liudmyla[a]**

[a] *The Institute of Radio Astronomy of NASU, Kharkiv, Ukraine*

***Corresponding author e-mail**: tishkovets@rian.kharkov.ua

Scattering of electromagnetic waves by discrete media is often accompanied by the weak localization effect, also known as the effect of coherent backscattering [1]. This effect manifests itself as a nonlinear increase in the brightness of the object when the scattering angles approach the exact backward direction of scattering. In astrophysics, this effect is associated with opposition effects (brightness and polarization) observed for Earth and other bodies in the Solar system [2]. We present the results of simulation the reflection matrix of radiation scattered by a discrete random medium, taking into account the weak localization effect. The simulation was performed using an efficient algorithm developed for solving the equation for weak localization in the case of a semi-infinite medium. Most of the results are given for media consisting of spherical homogeneous particles, although the algorithm is also applicable to media composed of arbitrary randomly oriented scatterers. The intensity and degree of linear polarization of radiation reflected by a medium are presented, as well as their dependence on the concentration, sizes, and refractive indices of the particles for certain angles of incidence of radiation on the medium boundary. The dependence of the weak localization effect on the azimuth of the scattering direction for oblique incidence of radiation on the medium is also considered.

**Keywords**: multiple scattering, coherent backscattering, opposition effects, discrete random medium

**References**

[1] Mishchenko M.I., Travis L.D., Lacis A.A. Multiple scattering of light by particles: radiative transfer and coherent backscattering. Cambridge, UK: Cambridge University Press; 2006.
[2] Mishchenko M.I., Rosenbush V.K., Kiselev N.N., Lupishko D.F., Tishkovets V.P., Kaydash V.G., Belskaya I.N., Efimov Y.S., Shakhovskoy N.M. Polarimetric remote sensing of Solar System objects. Kyiv: Akademperiodyka; 2010.