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Can microscopic structure of matter affect X-ray polarization radiation?

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When a fast charged particle induces polarization currents in a medium, these currents become a source of polarization radiation. Polarization radiation Vavilov-Cherenkov, transition, Smith-Purcell and other radiations. Although polarization radiation has a microscopic nature, its microscopic description is not well developed. Here we present the preliminary results of microscopic theory of X-ray polarization radiation. The theory is based on multipole decomposition of an atom's polarization current and a procedure of averaging radiation from individual atoms over the entire matter. Well-known formulas for solid and gas Cherenkov and transition radiation are obtained in the limiting cases. To describe the structure of matter, we use the correlation function. We find that, for highly porous polymers and sol-gel aggregates, the known expressions for Cherenkov and transition radiation are not applicable. We also discuss the microscopic theory in terms of the local field effects.
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