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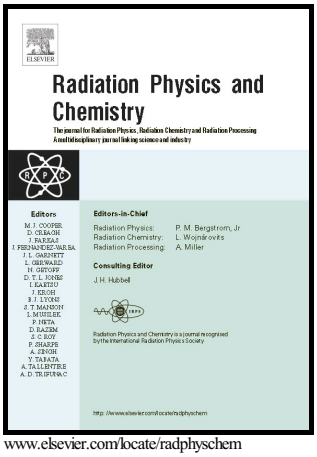

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Study of anisotropy of bremsstrahlung radiation emitted from 4.0 keV electrons in scattering by CH_4 molecule

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Abstract

A study of anisotropy of bremsstrahlung (BS) photons emitted from 4.0 keV electrons in scattering by a free CH_4 molecule is made by performing the measurements of cross sections of BS photons differential in energy and emission angle, that is, the doubly differential cross sections (DDCS). The DDCS spectra of BS photons were recorded using a Si -PIN photodiode detector in the energy range of 2.0 -3.8 keV and angular detection range of 45^0-120^0 relative to the incident beam direction of electrons. The measured angular distribution of BS photons suggests that the radiation emerging from the considered electron-molecule collisions is anisotropic and its relative magnitude depends on the energy of emitted photons. The experimental DDCS spectra of CH_4 are compared with DDCS spectra calculated from the atomic field bremsstrahlung formulations of Kissel- Quarles-Pratt (KQP) using additivity hypothesis. A good agreement is observed between the measured DDCS of CH_4 molecule and those obtained from KQP theory. The anisotropy of the radiation, that is, its angular asymmetry is found to compare reasonably well with the predictions of KQP. The anisotropy of the dipole radiation as often defined by a polarization parameter P (or degree of polarisation) is found to vary from (29.0±9)% to (70.0±9)% for photons with energy ranging from 2.0 keV to 3.8 keV, respectively.

Keywords:
bremsstrahlung radiation, angular distribution, anisotropy, polarization parameter, KQP theory