CCIT Report #820 November 2012

Enhanced Emission of Thermal Radiation due to Geometric Effects

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Abstract. Planck's formula for blackbody radiation was formulated subject to the assumption that the radiating body is much larger than the emitted wavelength. We demonstrate that thermal radiation exceeding Planck's law may occur in a narrow spectral range when the local radius of curvature is comparable with the wavelength of the emitted radiation. Fluctuation Dissipation Theorem needs to be employed for adequate assessment of the spectrum in this regime. Several simple examples are presented as well as experimental results demonstrating the effect.

From the early days of quantum mechanics via astrophysical measurements to today's nanostructures, blackbody radiation (BBR) played and plays a pivotal role in physics. As the emitting bodies were always much larger than the wavelength of interest, Planck's formula (PF) described adequately the general trend of the emerging radiation and any deviations were descried in terms of the so-called emissivity - which is a characteristic of the specific body or material. Conceptually, the emissivity is assumed to be always smaller than unity, explicitly assuming that PF provides the upper limit of what a body can emit. For quite some time, manufacturing techniques facilitate implementation of minute structures of a size smaller or of the same order of magnitude as the radiation wavelength, leading to a new regime of operation in which PF no longer