Thermodynamics of the Gas of Photons in the Near-Field

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We present a thermodynamic description of the gas of photons in a confined geometry, under near-field conditions. Starting from the free energy of the gas, we obtain thermodynamic quantities such as the pressure and the heat capacity. Increasing the volume occupied by the gas, the expressions for these quantities tend to the well-known formulas found in the black-body limit. The expression for the pressure leads to the Casimir force. The results are extended to the case in which the gas is subjected to a temperature gradient which has been treated experimentally. Our thermodynamic description enables one to obtain the efficiency of energy converters using thermal radiation.