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TECHNICAL NOTE

**Terms related to Planckian radiation
temperature for light sources**

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Terms related to Planckian radiation temperature for light sources

Summary

There are several terms which describe the Planckian radiation temperature for light sources, including radiance temperature, colour temperature, correlated colour temperature, distribution temperature and ratio temperature. This document provides descriptions of these terms, information on their applicability, and highlights relationships between them so that they may be consistently applied in all applications.

Definitions and additional explanatory information for each term are given in this document. Obviously, the greater the difference between the radiation considered and a Planckian radiator, the more tenuous the interpretation of the temperature attribution. Guidelines as to agreed reasonable limits of applicability, if any, are therefore also given, together with information on the calculation of the associated measurement uncertainties where relevant.

1 Introduction

This document is written sequentially, in that quantities that form the basis of dependent quantities are mentioned first, so reading the entire document is recommended.

Radiation from an incandescent lamp has a relative spectral power distribution which is reasonably close to that of a Planckian radiator (also known as a blackbody or full radiator). Since a single parameter, temperature, can be used with Planck's formula to define a complete spectral power distribution of a blackbody, it is often convenient to describe incandescent radiation, especially from tungsten lamps, in terms of the temperature of an equivalent Planckian radiator.

Several terms as listed above, used in optical radiation measurement, make use of this concept to assign a temperature measure to a spectral power distribution. The difference between the terms is in the way in which the corresponding Planckian radiator is selected. Values for all of these terms are expressed in the unit of kelvin as a positive real number above absolute zero, the theoretical point at which particles have zero energy.

2 Thermodynamic temperature

2.1 Symbol

T

2.2 Definition

positive state quantity proportional to the kinetic energy of the chaotically moving particles that constitute a physical system being locally in equilibrium

[SOURCE: IEC 60050-113:2011 (Electropedia, Subject area 113), 113-04-14, online: <http://www.electropedia.org/iev/iev.nsf/display?openform&ievref=113-04-14>, modified – notes to entry omitted]

2.3 Additional information

The definition in 2.2 is accurate only at temperatures well above zero kelvins, which is the case for all foreseeable application of this document.

The thermodynamic temperature is an absolute measure of the average total energy of the particles comprising a solid material, liquid or gas, i.e. the total internal energy of a substance or an object.