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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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Colorimetry - Part 4: CIE 1976 L*a*b* colour space

色度学 第4部分：CIE 1976 L* a* b*颜色空间

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part

1. Structure and Drafting Rules of Standardization Documents" Drafting. This document is Part 4 of GB/T 20147 "Colorimetry". GB/T 20147 has released the following parts.

---Part 3: CIE tristimulus value;

---Part 4: CIE1976L*a*b* color space. This document is modified to adopt ISO /CIE11664-4:2019 "Colorimetry Part 4: CIE1976L*a*b* Color Space". The technical differences between this document and ISO /CIE11664-4:2019 and their reasons are as follows:

---Replaced CIE S017 (see Chapter 3) with normatively cited GB/T 2900.65 to adapt to my country's technical conditions, adding Operability. Please note that some content in this document may be subject to patents. The publisher of this document assumes no responsibility for identifying patents. This document is proposed by China Light Industry Federation. This document is under the jurisdiction of the National Lighting Appliances Standardization Technical Committee (SAC/TC224). This document was drafted by: China Institute of Metrology, Foshan Electrical and Lighting Co., Ltd., Zhejiang University, Shenzhen Kangguan Technology Co., Ltd. Co., Ltd., Guangdong Zhongsi Micro Optoelectronics Co., Ltd., Chengdu Hengkun Optoelectronics Technology Co., Ltd., Shenzhen Senbang Lighting Co., Ltd., Shenzhen Shenzhen Arctic Light Technology Co., Ltd., Fudan University, Beijing Electric Light Source Research Institute Co., Ltd., Wuhan University, China Illuminating Society, Wuxi University, Communications and Signal Research Institute of China Academy of Railway Sciences Group Co., Ltd. The main drafters of this document. Liu Hui, Yu Shaotao, Xu Haisong, Ye Wei, Chen Maohua, Cheng Shengpeng, Huo Yongfeng, Li Zhengjun, Xie Qingbo, Lin Yandan, Zhang Bo, Liu Qiang, Xu Xinxin, Huang Sungang, Li Toyota.

The three-dimensional color space drawn by the CIE tristimulus values (X , Y , Z) in the Cartesian coordinate system is visually uneven, (x , y , Y) The color space and CIE(x , y) two-dimensional chromaticity diagram are also non-uniform. Equal distances in these spaces do not represent color differences between color stimuli. Differences in color perception. Therefore, in 1976 CIE introduced and recommended two new color spaces (called CIELAB and CIELUV), whose coordinates are nonlinear functions of X , Y and Z . The proposal was introduced to unify the many uniformities arising from practice at the time. Color spaces and color difference formulas. Both of these more uniform color spaces are widely accepted and used. It uses simple Euclidean geometric distance Distance or more complex formulas can be used to approximately describe the size of the color difference to improve the correlation between color perception and color difference. The purpose of this document is to define a process for calculating the chromaticity coordinates of the L^* , a^* , b^* (CIELAB) color space and the Euclidean color difference based on these coordinates. Procedure. This document does not include more complex color difference formulas based on CIELAB color space, such as CMC formula, CIE94 formula, DIN99 formula formula and the CIEDE2000 formula, nor does it include the alternative uniform color space CIELUV. According to the characteristics of different workplaces, GB/T 20147 is planned to be divided into the following six parts.

---Part 1: CIE standard colorimetric observer. The purpose is to specify two sets of color matching functions in colorimetry.

---Part 2: CIE standard lighting body. The purpose is to specify two standard illuminants in colorimetry.

---Part 3: CIE tristimulus value. The purpose is to specify a method for calculating the tristimulus value of a color stimulus of known spectral distribution.

---Part 4: CIE1976 $L^*a^*b^*$ color space. The purpose is to specify the calculation of CIE1976 $L^*a^*b^*$ color space coordinates method and two methods for calculating Euclidean color difference in this space.

---Part 5: CIE1976 $L^*u^*v^*$ color space and u' , v' uniform chromaticity scale diagram. The purpose is to specify the calculation CIE1976 $L^*u^*v^*$ color space coordinate method, two methods for calculating Euclidean color difference in this space, and calculating u' , v' uniformity Method for chromaticity scale diagram coordinates.

---Part 6: CIEDE2000 color difference formula. The purpose is to specify the method for calculating color difference based on the CIEDE2000 color difference formula. Colorimetry

Part 4: CIE1976 $L^*a^*b^*$ color space

1 Scope

GB/T 20147.4-2023 specifies the CIELAB colour space, the coordinate system in which colour differences are stated across most of industry. Its purpose is perceptual uniformity:

the earlier tristimulus spaces describe colour correctly but unevenly, so the same numerical distance means a large difference in one region and an imperceptible one in another, which makes a tolerance meaningless. CIELAB was constructed so that geometric distance approximates perceived difference, which is why a paint, textile, plastics or print specification says ΔE and expects the number to mean the same thing everywhere. This part specifies the method for calculating the lightness, chroma and hue quantities of CIE 1976 $L^*a^*b^*$ colour space coordinates, and gives two methods for calculating the Euclidean distance representing perceived colour difference. Under ICS 29.140.01 and CCS K71, it is the working reference for colour measurement laboratories, for quality control wherever colour is a specified attribute, and for the software that computes colour differences inside spectrophotometers and colour management systems.

This document specifies a method for calculating the brightness, chroma and hue related quantities of CIE1976 $L^*a^*b^*$ color space coordinates, which includes Two methods for calculating the Euclidean geometric distance that represents color perception differences in color space. This document applies to the CIE1931 standard colorimetric system or the CIE1964 standard colorimetric system that uses color matching functions to calculate tristimulus values. system. This document can be used to describe the color properties of reflective or transmissive objects, in which case a more uniform than tristimulus color space is required three-dimensional color space. This document applies to self-illuminating displays, such as cathode ray tubes, if they are used to simulate color stimuli from reflective or transmissive objects, and and color stimuli were appropriately normalized. This document does not apply to color stimuli that are primarily illuminated by the light source itself or that specularly reflect that luminous area. The method of calculating the inverse transformation is given in Appendix A.

2 Normative reference documents

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, the dated quotations For undated referenced documents, only the version corresponding to that date applies to this document; for undated referenced documents, the latest version (including all amendments) applies to this document.

GB/T 2900.65 Electrical terminology lighting [GB/T 2900.65-2004,
IEC 60050(845).1987, MOD]

3 Terms and definitions

The terms and definitions defined in GB/T 2900.65 apply to this document.

4 Symbols and abbreviations

The following symbols and abbreviations apply to this document. X, Y, Z are calculated using the color matching function of the CIE1931 standard colorimetric system (also known as the CIE2 standard colorimetric system) tristimulus value X_n, Y_n, Z_n Tristimulus values for a specific white stimulus calculated using the color matching function of the CIE1931 standard colorimetric system L^* CIE1976 lightness (CIELAB lightness) a^*, b^* CIELAB a^*, b^* chromaticity coordinates C^*_{ab} CIE1976 a, b chroma (CIELAB chroma) h_{ab} CIE1976 a, b hue angle (CIELAB hue angle) ΔL^* CIELAB brightness difference $\Delta a^*, \Delta b^*$ CIELAB a^*, b^* chromaticity coordinate difference ΔC^*_{ab} CIELAB a^*, b^* chroma difference Δh_{ab} CIELAB hue angle difference