ICS 01.040
CCS A 22

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 43737-2024

Terminology for quantum measurement

量子测量术语

Issued on: March 15, 2024 **Implemented on: October 1, 2024**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

Table of Contents

Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1.Structure and drafting rules for standardization documents" Drafting. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed and coordinated by the National Technical Committee on Quantum Computing and Measurement Standardization (SAC/TC578). This document was drafted by: China Institute of Metrology, University of Science and Technology of China, China Electronics Information Industry Group Co., Ltd., Guodun Quantum Technology Co., Ltd., Zhijiang Laboratory, Shanxi University, Huazhong University of Science and Technology, China Academy of Information and Communications Technology, China Academy of Space Technology Beijing Radio Measurement and Testing Institute, Inspur Electronic Information Industry Co., Ltd., Institute of Precision Measurement Science and Technology Innovation of the Chinese Academy of Sciences Institute of Microsystem and Information Technology, Chinese Academy of Sciences, China University of Metrology, China Academy of Space Technology, People's Liberation Army National University of Defense Technology, Xi'an Institute of Microelectronics Technology, 9th Academy of Aerospace, Jinan Institute of Quantum Technology, Shenzhen Institute of Metrology Technology Innovation Research Institute, the 33rd Institute of the 3rd Academy of China Aerospace Science and Industry Corporation, Shandong Guoyao Quantum Radar Technology Co., Ltd., Guoyi Zi (Hefei) Technology Co., Ltd. The main drafters of this document are. Qu Jifeng, Xu Jinshi, Li Wenwen, Wang Zengbin, Zhao Meisheng, Zhang Ning, Ye Wen, Dai Hanning, Wang Junmin, Hu Zhongkun, Zhang Meng, Xue Xiaobo, Hu Huizhu, Zeng Yu, Feng Mang, Rui Jun, Wang Haomin, Zhao Chunliu, Zhang Shengkang, Song Hongting, Liu Weitao, Cheng Jiaming, Yu Chunlin, Zhou Fei, Pan Yijie, Song Zhenfei, Wan Shuangai, Li Yanruoyue, Shentu Guoliang, Wan Chuanqi. Quantum Measurement Terminology

1 Scope

China's national terminology for quantum measurement. Quantum metrology is the field in which measurements are made against quantum-mechanical invariants rather than artefacts, and it has become the basis of the entire international system of units - the kilogram now defined through the Planck constant, the second through an atomic transition, the ampere through the elementary charge. The vocabulary matters because the field draws on physics, on metrology and on engineering, each of which uses some of the same words differently, and because it is developing fast enough that terms are coined before they settle. A standard vocabulary is what allows a specification for a quantum sensor to be written, a calibration certificate to be understood, and a claim of quantum advantage to be assessed rather than merely asserted - which in a field with as much commercial enthusiasm as this one is a real service.

This document defines basic terms and definitions related to quantum measurements. This document is applicable to the formulation of quantum measurement-related standards, preparation of technical documents, writing of textbooks and books, and literature translation.

2 Normative references

This document has no normative references.

3 General Basics

3.1 Quantum measurement Obtain the state of quantum systems, and use the smallest, discrete, indivisible characteristics of quantum and quantum spin, quantum coherence, quantum compression, Measurement of properties such as quantum entanglement.

3.2 Quantum metrology The International System of Units (SI) base units are defined based on fundamental physical constants, and the units of measurement are reproduced using quantum systems, quantum properties or quantum phenomena. values or measurements that are directly traceable to fundamental physical constants.

Note. Also used in other high-precision measurement studies.

3.3 Quantum sensing The process of using quantum properties to achieve high-precision measurement of physical quantities and converting them into usable signals according to certain rules.

3.4 quantum state The state of a quantum system. [Source: GB/T 42565-2023, 3.1]

3.5 Information about the sensitivity of the state of a quantum system to the parameters to be measured.

Note. An extension of the classical Fisher information used to determine the highest

precision of parameter measurements.

3.6 Two non-commutative observables cannot be determined simultaneously. The smaller the uncertainty of one observable, the smaller the uncertainty of the other observable. The more qualitative the physical relationship.

3.7 Heisenberg limit In a particular quantum state (3.4), a given observable of a quantum system is subject to the measurement uncertainty of its non-commutative observable. The limit of achievable measurement accuracy.