About
National Scientific Centre “Institute of Metrology”, Kharkov, Ukraine, for 24th meeting of CCU

National Scientific Centre
“Institute of Metrology”

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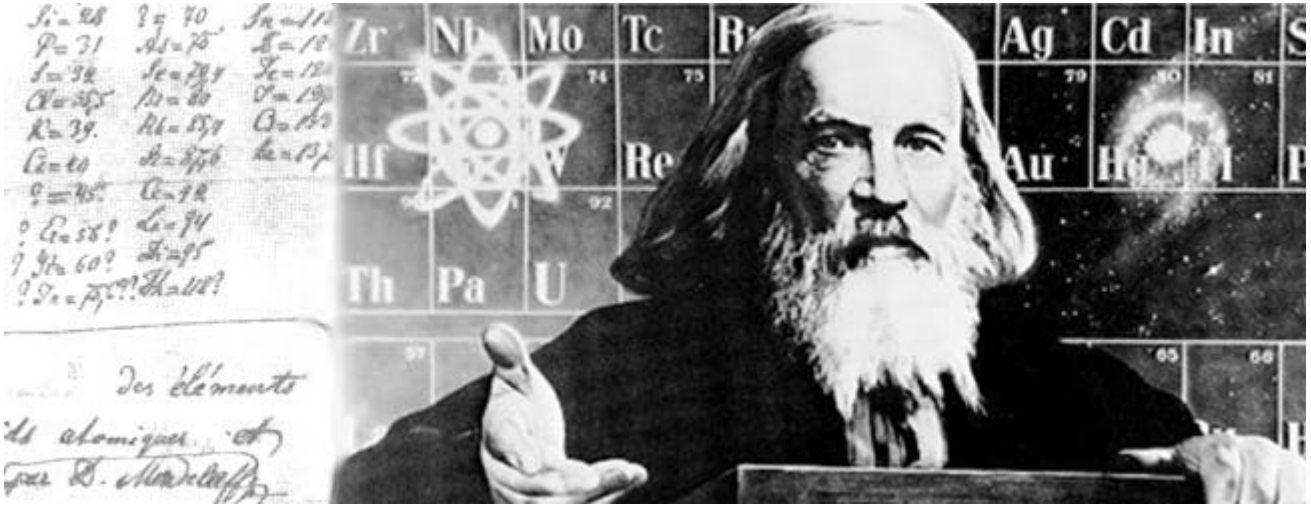
The history of National Scientific Centre "Institute of Metrology" began on **8 October, 1901**, when at the initiative of an outstanding scientist Dmitry Ivanovich Mendeleyev the first Ukrainian verification chamber was established in Kharkiv with the functions of verification and stamping the trade weights and measures.



Today. National Scientific Centre “Institute of Metrology”

National Scientific Centre “Institute of Metrology”

National Scientific Centre “Institute of Metrology”

Metrology for society

Promoting the protection of the consumer rights, ensuring the high quality of life

- Development of measurement methods and instruments necessary for all spheres of human living and household activities
- Health and life protection
- Control of the environment and safety of working conditions
- Protection of consumers during trade operations and transactions
- Reliable measurements in the sphere of public utilities (electricity, gas and water supply)

Metrology for economy

Increasing the efficiency of economy, innovation, employment security

- Metrological certification, calibration and verification of measuring instuments
- Metrological review of technical documentation
- Development and certification of measurement techniques
- Development of the national measurement standards, including those harmonised with the international ones
- Certification of calibration laboratories

International relations

Elimination of technical barriers in trade, unification of measurement system

- Cooperation with other National Metrology Institutes
- Harmonisation of normative documents and elimination of non-tariff barriers in trade
- Participation in international metrological organisations
- Promoting the international unification of metrology

Fundamentals of metrology

Developments related to reproduction, maintenance and transfer of SI units

- Fundamental and applied scientific research
- Creation of scientific and technical base for metrological system that meets up-to-date requirements
- Scientific and methodological support of metrological activity
- Certification training of metrologists

National Scientific Centre "Institute of Metrology"

These studies have formed the basis for laser range measurements

REVIEWS OF
MODERN PHYSICS

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Determination of e/h, Using Macroscopic Quantum Phase Coherence in Superconductors: Implications for Quantum Electrodynamics and the Fundamental Physical Constants

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The implications of the new determination of e/h using the ac Josephson effect in superconductors for both quantum electrodynamics (QED) and our knowledge of the fundamental physical constants are analyzed in detail. The implications for QED are investigated by first deriving a value of the fine structure constant α from experimental input data which do not require the use of QED theory for their analysis. These include the Josephson-effect value of e/h, the Faraday constant, the gyromagnetic ratio of the proton, the magnetic moment of the proton in units of the nuclear magneton, the ratio of the ampere as maintained by the United States National Bureau of Standards to the absolute ampere, and certain accurately known auxiliary constants. This is done by critically reevaluating all of the experimental data presently available on these quantities and applying the standard techniques of a least squares adjustment, including tests for incompatibility. The value of α so obtained is then used to evaluate the theoretical expressions for the Lamb shift and fine structure splitting in hydrogen, deuterium, and ionized helium, the hyperfine splitting in hydrogen, muonium, and positronium, and the anomalous magnetic moment of the electron and muon. These theoretical values are compared with critically reexamined experimental values, thus providing a test of QED in which *a priori* information from QED itself is not essential. The consequences of the new measurement of e/h for our present knowledge of the fundamental physical constants are demonstrated by deriving new "best" values for the fundamental constants from a critically selected subset of all the available data. In addition to providing a consistent set of constants, this analysis focuses attention on areas in which there remain important questions which require clarification. The experimental and theoretical work necessary for the resolution of these questions is discussed, with emphasis on ways in which the study of quantum phase coherence effects in low temperature superfluid systems can make significant contributions.

CONTENTS

* Alfred P. Sloan Foundation Fellow.
† Supported by the National Science Foundation and the Advanced Research Projects Agency.

TABLE IV. Summary of some velocity-of-light measurements made since 1948 (MWI, microwave interferometer; IRRS, infrared rotational spectrum; FLRC, fixed-length resonant cavity; VLRC, variable-length resonant cavity). (Probable errors have been converted to standard deviations by multiplying by 1.48.) The errors quoted for the Kolibayev and Grosse geodimeter measurements are statistical only.

Year of publication	Author	Method	c (km/sec)
1967	Simkin, Lukin, Sikora, and Strelenskii	MWI	299 792.56±0.11
1967	Grosse	Geodimeter	299 792.5±0.05
1965	Kolibayev	Geodimeter	299 792.6±0.06
1950–1962	McNish (1962) summary of data of Bergstrand, USCGS, and others	Geodimeter	299 792.6±0.25
1958	Froome	MWI	299 792.50±0.10
1955	Florman[a]	RWI	299 795.1±1.5
1955	Plyler, Blaine, and Connor[b]	IRRS	299 792±6
1954	Froome [revised, Froome (1958)]	MWI	299 792.75±0.30
1952	Froome	MWI (first instrument)	299 792.6±0.7
1951	Aslakson[c]	Shoran	299 794.2±2.8
1950	Bol[d]	FLRC	299 789.3±1.0
1950	Essen[e]	VLRC	299 792.5±1.5
1949	Aslakson[c]	Shoran	299 792.4±3.6
1948	Essen and Gordon-Smith[f]	FLRC	299 792±4.5

[a] E. F. Florman, J. Res. Natl. Bur. Std. **54**, 335 (1955).
[b] E. K. Plyer, L. R. Blaine, and W. S. Connor, J. Opt. Soc. Am. **45**, 102 (1955).
[c] C. I. Aslakson, Trans. Am. Geophys. Union **32**, 813 (1951); **30**, 475 (1949); Nature **168**, 505 (1951); **164**, 711 (1949).
[d] K. Bol, Phys. Rev. **80**, 298 (1950).
[e] L. Essen, Proc. Roy. Soc. (London) **A204**, 260 (1950).
[f] L. Essen and A. C. Gordon-Smith, Proc. Roy. Soc. (London) **A194**, 348 (1948).

Year of publication	Author	Method	c (km/sec)
1967	Simkin, Lukin, Sikora, and Strelenskii	MWI	299 792.56±0.11

History. Determination of Proton Gyromagnetic Ratio

National Scientific Centre "Institute of Metrology"

The 1973 Least-Squares Adjustment of the Fundamental Constants*

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This paper is a summary of the 1973 least-squares adjustment of the fundamental physical constants carried out by the authors under the auspices of the CODATA Task Group on Fundamental Constants. The salient features of both the input data used and its detailed analysis by least-squares are given. Also included is the resulting set of best values of the constants which is to be recommended for international adoption by CODATA, a comparison of several of these values with those resulting from recent past adjustments, and a discussion of current problem areas in the fundamental constants field requiring additional research.

Key words: Data analysis; fundamental constants; least-squares adjustments; quantum electrodynamics.

Contents

*Work partially supported by the U.S. National Bureau of Standards Office of Standard Reference Data.

TABLE 14.1. Summary of γ'_p determinations

Publication date, laboratory[a], and author	γ'_p	γ'_p	γ'_p	Uncertainty (ppm)	Eq. No.
	Low Field				
	$10^8\ s^{-1}\cdot T^{-1}{}_{LAB}$	$10^8\ s^{-1}\cdot T^{-1}{}_{BIPM}$	$10^8\ s^{-1}\cdot T^{-1}{}_{B169}$		
1968, ETL Hara et al.[b]	2.6751384(107)	2.6751449(107)	2.6751156(107)	4.0	(14.1)
1972, NBS Olsen and Driscoll[c]	2.6751344(54)		2.6751370(54)	2.0	(14.2)
1965, NPL Vigoureux[d]	2.6751707(107)	2.651480(107)	2.6751187(107)	4.0	(14.3)
1971, VNIIM Malyarevskaya, Studentsov, and Shifrin[e]	See text.		2.6751100(161)	6.0	(14.4)
	High Field				
	$10^6\ A_{LAB}\cdot s\cdot kg^{-1}$	$10^6\ A_{BIPM}\cdot s\cdot kg^{-1}$	$10^6\ A_{BNS}\cdot s\cdot kg^{-1}$		
1966, KhGNIIM Yagola, Zingerman, and Sepetyi[f]	2.675079(20)[h]	2.675101(20)	2.675130(20)	7.4	(14.5)
1971, NPL Kibble and Hunt[g]	2.675075(43)		2.675075(43)	16	(14.6)

[a] ETL = Electrotechnical Laboratory, Japan; KhGNIIM = Kharkov State Scientific Research Institute of Metrology, U.S.S.R.
[b] Refs. [0.1, 14.2]. [c] Ref. [14.3]. [d] Refs. [0.1, 14.4]. [e] Refs. [14.5, 14.6]. [f] Refs. [0.1, 14.7, 14.8].
[g] Refs. [14.9, 14.10]. [h] This result is in terms of A_{BIPM}, the ampere as maintained at VNIIM.

High Field

	$10^6\ A_{LAB}\cdot s\cdot kg^{-1}$	$10^6\ A_{BIPM}\cdot s\cdot kg^{-1}$	$10^6\ A_{BNS}\cdot s\cdot kg^{-1}$		
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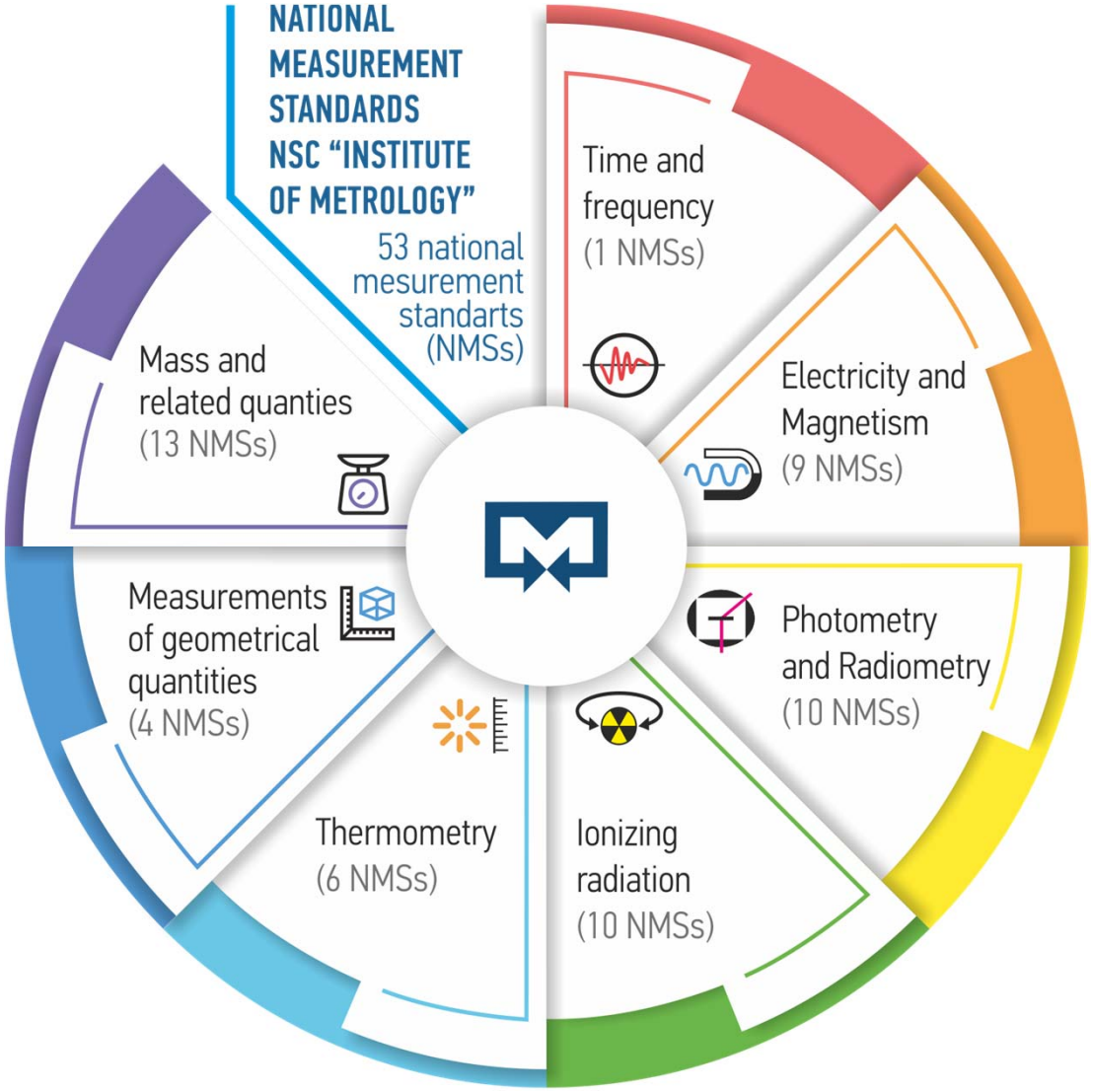
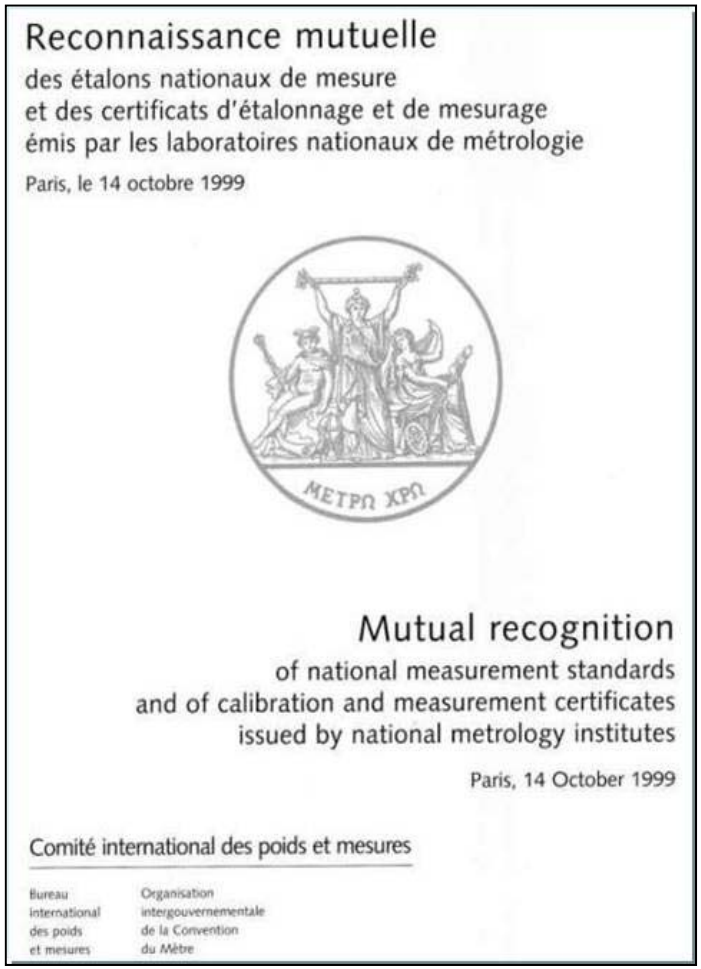
The National Measurement Standards of Ukraine



CIPM Mutual Recognition Arrangement


Reconnaissance mutuelle
des étalons nationaux de mesure
et des certificats d'étalonnage et de mesurage
émis par les laboratoires nationaux de métrologie
Paris, le 14 octobre 1999

ΜΕΤΡΩ ΧΡΩ

Mutual recognition
of national measurement standards
and of calibration and measurement certificates
issued by national metrology institutes
Paris, 14 October 1999

Comité international des poids et mesures

Bureau international des poids et mesures
Organisation intergouvernementale de la Convention du Mètre

CIPM Mutual Recognition Arrangement (CIPM MRA) was signed on October 14, 1999 by Directors of National Metrology Institutes from 38 states signatories and two international organisations.

CIPM MRA

Ukraine participates in the Arrangement since 2003

ANALYSIS OF REALISATION OF CIPM MRA

		Total	AUV	EM	L	M	PR	QM	RI	T	TF
Ukraine	DETU	**73**	3	16	5	17	11	4	10	6	1
	KC	50	7	5	2	6	4	20	-	5	1
	SC	63	2	17	12*	16	7*	3	5	1	-
	CMC	**275**	30	57	27	14	6	33	15	63	30
NSC “Institute of Metrology”	**DETU**	**53**	-	9	4	13	10	-	10	6	1
	KC	16	-	1	1	4	4	-	-	5	1
	SC	33	-	2	12	9	4	-	5	1	-
	CMC	**163**	-	19	23	7	6	-	15	63	30
SE “Ukrmetrteststandard”	DETU	**15**	-	7	1	2	1	4	-	-	-
	KC	27	1	4	1	1	-	20	-	-	-
	SC	29	-	15	1	4	6	3	-	-	-
	CMC	**79**	-	38	4	4	-	33	-	-	-
DP NDI “Systema”	DETU	**3**	3	-	-	-	-	-	-	-	-
	KC	6	6	-	-	-	-	-	-	-	-
	SC	2	2	-	-	-	-	-	-	-	-
	CMC	**30**	32	-	-	-	-	-	-	-	-
SE “Ivano-Frankivsk-standardmetrologiya”	DETU	**2**	-	-	-	2	-	-	-	-	-
	KC	1	-	-	-	1	-	-	-	-	-
	SC	3	-	-	-	3	-	-	-	-	-
	CMC	**3**	-	-	-	3	-	-	-	-	-

Publishing activity of NSC “Institute of Metrology” has many years of publishing experience.

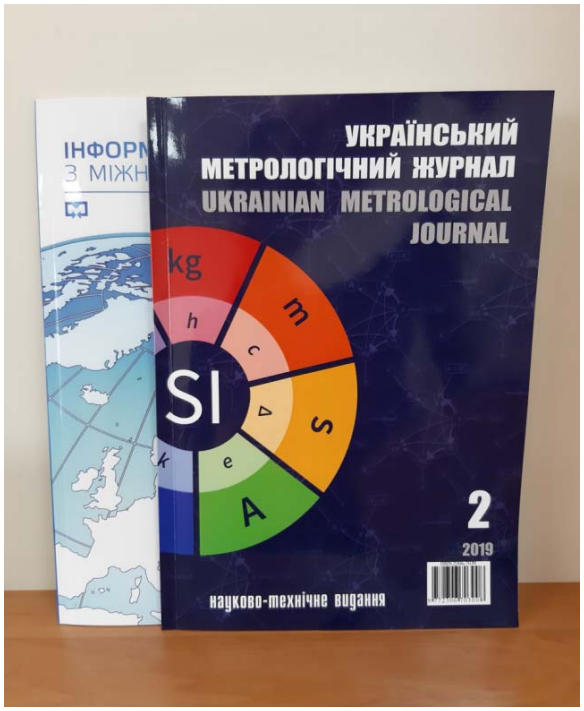
“Ukrainian Metrological Journal“ (UMJ) is a specialized scientific and technical edition, founded by National Scientific Centre “Institute of Metrology" in **1995**, first as the “Ukrainskyi Metrolohichnyi Zhurnal” (“Ukrainian Metrological Journal”), and in 2017, in order to expand the geography of publications and readers, an English translation was added to the title.

UMJ web-site address: www.umj.metrology.kharkov.ua

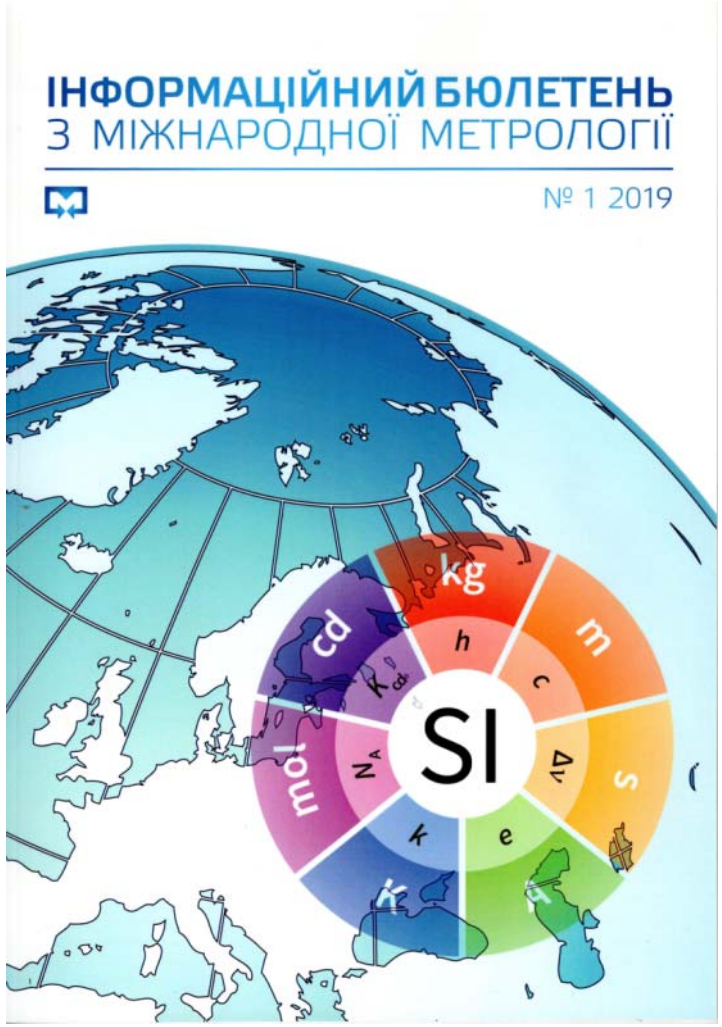
“Ukrainian Metrological Journal” is indexed by an international bibliometric and scientometric database of **Google Scholar**.

The edition has an identifier for a digital object (**DOI: 10.24027 / 2306-7039**).

In July 2019 UMJ was included in the leading scientometric, abstract, international citation database in the world **Web of Science** Core Collection (Web of Science until 2014).



PUBLISHING ACTIVITY



Since 2014, NSC “Institute of Metrology” has been publishing the **“Information Bulletin on International Metrology”**, which is published twice a year.

Now the 12th edition is being prepared for release.

The Bulletin acquaints readers with the activities of international and regional organizations on metrology and their fundamental documents, as well as with the metrological infrastructure of different countries of the world; informs about international events and new world achievements in the field of metrology.

Under the guidance of COOMET, NSC “Institute of Metrology” performs biennially **International Scientific & Technical Conference “METROLOGY AND MEASUREMENT TECHNIQUES”**.

The purpose of the conference is to promote the development of metrology and to implement its achievements in researches, practice and study.

Thank you for your attention very much!

Professor Pavel Neyezhmakov

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