

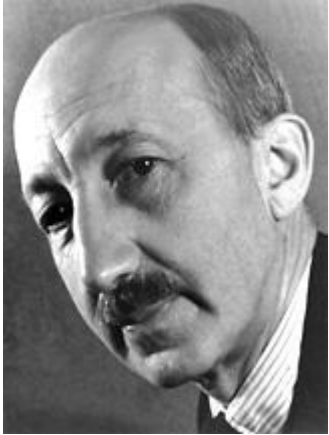
# Neutron-activation analysis at DNS-IV of JINR as a center of excellence in nuclear analytics



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# Neutron activation analysis- look back



George Hevesy, Nobel Prize winner

1936- first paper on activation analysis by Hevesy and Levi  
(determination of Eu and Dy in yttrium sample)

Intensive development of the method in the 50-th years after the appearance of high-flux neutron sources (nuclear reactors)

1953: Vernadsky Institute, the first works on NAA in the USSR by Alimarin I.P. and Yakovlev Yu.V., state prize winners, 1972



# NAA geography in the past/**now**



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Председатель  
Научного Совета АН  
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методов ядерной  
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## Город

## Ведущие сотрудники

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Саласпилс (Латвия)

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Мосулишвили Л.М.

**Ташкент (Узбекистан)**

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Апатиты

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Смахтин Л.А.

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Москва, МИФИ

Росляков Н.П.

**Москва, ОИЯИ, Дубна**

Назаров В.М., Фронтасьева М.В.

# NAA has made significant progress in the analytical chemistry of trace elements

INAA|RNAA: High sensitivity, multi-element, independence from the purity of chemical reagents and many other advantages.

- Geology and geochemistry (rocks, minerals, inclusions...),
- Cosmochemistry (analysis of Moon rock, meteorites, dust...),
- Nuclear materials (including low activation structural materials for fusion reactor) ,
- High purity materials,
- Life sciences (metallomics, biology, medicine incl. “in vivo”)
- Environmental protection,
- Applied fields (forensic, fine art analysis, archeology, etc.).

# CCQM

Consultative Committee for Amount of Substance:  
Metrology in Chemistry and Biology (CCQM)

<http://www.bipm.org/en/committees/cc/ccqm>



- The method of neutron activation analysis was adopted by the Committee as meeting the requirements for the primary method of analysis (primary ratio method ). Because **the origin of all components of uncertainty of measurement results** (a list consisting of more than 40 items) is studied in detail and detailed recommendations are given to assess their contribution.
- ICP-MS, which currently dominates for elemental analysis, has the status of the recommended method for trace analysis

# Definition of the primary method

The Comité Consultatif pour la Quantité de Matière — Métrologie en Chimie (CCQM, Consultative Committee on Amount of Substance— Metrology in Chemistry) has defined [Minutes from the Fifth Meeting (February 1998) of the CCQM, held at the Bureau International des Poids et Mesures (BIPM), Sèvres, France] a primary method as:

“A primary method of measurement is a method having the highest metrological properties, whose operation can be completely described and understood, for which a complete uncertainty statement can be written down in terms of SI units”.

Now the obtaining potentially breakthrough results in the field of geochemistry, cosmochemistry and other disciplines depends on the availability of precision and highly sensitive methods of studying the substance, including elemental/isotopic composition.

One example. Characterization of carbon nanomaterials (detonation nano diamonds, nano tubes, graphene) as pharmaceuticals carrier. Just NAA delivers highest metrological level!

In the case of NAA, progress implies the use of high-intensity neutron fluxes, selective activation (e.g. by means of epithermal neutrons), measurements with highest efficiency, automatization of data processing<sup>7</sup>.

# Conclusion

The inclusion of the NAA method developing in JINR in the implementation program for new neutron source will ensure further progress of the existing competence center in this field (the only one in RF today).



