

## 会議のトピックス(V)

### Report on the 11-th International Seminar on Interaction of Neutrons with Nuclei (ISINN-11) (Dubna, Russia, May 28~31, 2003)

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The 11-th International Seminar on Interaction of Neutrons with Nuclei (ISINN-11) was held in Dubna from May 28 to 31, 2003. The ISINN-11 was dedicated to the 95th anniversary of academician I.M. Frank (1908-1990). This seminar covers fundamental interactions of neutrons, nuclear structure, ultracold neutrons, and related topics. The number of participants was about 100 including about 30 foreigners from 14 countries. From Korea, I and Prof. Tae-Ik Ro in Dong-A University were attended from May 29 to 31. There are no attendances from China due to “Sars”. There are also no Japanese in this year.

ISINN-11 had eight sessions; (1) Neutron Facilities, (2) Symmetry violations and Fundamental Properties of the Neutron I and II, (3) Methodical Aspects, Nuclear Data, Resonance Parameters, and Applied Studies, (4) Environmental Studies, (5) Ultracold Neutrons, (6) Nuclear Structure, (7) Theory, (8) Fission. In addition to the oral presentation, there are two poster sessions. There were also special programs: a round table discussion in commemoration of Prof. I.M. Frank (May 28), a concert done by students group in Dubna area (May 29), a barbeque picnic which was traditionally held on the bank of Dubna river (May 30). After the ISINN-11, there was a trip to St. Petersburg.

#### **May 28**

##### (1) Neutron Facility

M. Daum (PSI, Switzerland) presented the ultracold neutron facility at PSI. This facility consists of a pulsed proton beam with a high intensity ( $I_p \gg 2$  mA) and a very low duty cycle (1%), a heavy element spallation target and a moderator consisting of solid deuterium kept at a

temperature of about 6 K. E. Gutmiedl (FRM, Germany) reported a ultracold neutron facility (the Mini-D<sub>2</sub> UCN source) which is proposed at the new Munich high-flux reactor FRM-II for storage experiments. In the pulsed operation mode the Mini-D<sub>2</sub> source is expected to provide UCN densities up to  $10^4$  n/cm<sup>3</sup>. O. Kaltchenko (KRR, Ukraine) reported a “Neutron Source for Boron Neutron Capture Therapy at Kyiv Research Reactor” and P. Cennini (CERN, Switzerland) described the “Current Status of n\_TOF CERN facility and its research program”.

## (2) Symmetry violations and Fundamental Properties of the Neutron I and II

Five talks are related to parity-violation: “Search for P- and T-Invariance Violation in Angular Correlation Experiments” (Yu.M. Tchuvil’sky, Russia), “Nature of the parity violation in interaction of neutrons with lead” (J. Andrzejewski, Poland), “Signs of P-Odd and P-even Observables in Neutron Induced Reactions” (L.M. Smotrisky, PNPI, Russia), “Recent Results on the Measurement of the P-Odd Asymmetry of Emitted  $\gamma$ -quanta in the  $^{10}\text{B}(n,\alpha)^7\text{Li}^* \rightarrow ^7\text{Li}(g.s)$  Reaction with Slow Polarized Neutrons” (P.V. Sedyshev, JINR, Russia), and “Calculation of Parity Violation Effect in 478 keV Gamma-Transition in  $^7\text{Li}$  by Resonating Group Model Approach” (Yu.S. Igashov, Russia). Two papers are related to the time-violation: “The emiT Experiment: A Search for Time Reversal Invariance Violation in Polarized Neutron  $\beta$ -decay” (P.A. Mumm, Washington U., USA), and “Search for P- and T-Invariance Violation in Angular Correlation Experiments” (Yu.M. Tchuvil’sky, Russia). There is a special topics related to the “Preliminary Results of Investigation of Quantum States of Neutrons in the Earth’s Gravitational Field” (V.V. Nesvizhevsky, ILL, France).

### (3-1) Methodical Aspects

Two talks are related to UCN source: One is “Structure and Origin of Background in Neutron Magnetic Storage Experiment” (V.V. Vasiliev, ITEP, Russia), in which the neutron life time was reported as  $\tau_n = 900.01 \pm 0.15$  sec, the other for “A new UCN source for Cryogenic EDM Experiment” (S. Balashov, UK).

## May 29

### (3-2) Nuclear Data, Resonance Parameters, Applied Studies

Four capture cross section and one total cross section measurements were reported: M. Heil (Germany) reported “ $^{151}\text{Sm}(n,\gamma)$  studies at n\_TOF (CERN)”, N. Janeva (Bulgaria) presented the results from Geel about “Neutron Capture of  $^{232}\text{Th}$  in the Unresolved Resonance Region”, T.I. Ro (Korea) reported “Capture Cross Section Measurements of  $^{157}\text{Gd}$  and  $^{158}\text{Gd}$  in the Neutron

Energy Region Between 10 keV and 90 keV” done at the 3-MV Peletron Accelerator of the Research Laboratory for Nuclear Reactors at Titech, Japan, and Yu. Grigoriev (Russia) reported “The Measurements of the Capture Cross Sections of Nb, Mo and Ho in the Energy Region from 20 eV up to 50 keV” which was measured at the 501 m and 121 m flight pathies of the IBR-30 in JINR. G.N. Kim (Korea) presented “Measurement of Neutron Total Cross Section of Dy, Ag, and Sm at Pohang Neutron Facility” based on 60 MeV electron linac of Pohang Accelerator Laboratory, Korea.

B.V. Zhuravlev (Russia) talked on “Measurements of Leakage Neutron Spectra from Thick Spherical Shells of Vanadium and Lead with 14 MeV Neutrons and Validation of their Nuclear Data” which was done at the pulsed neutron generator KG-03 of IPPE, Obninsk.

O. Gritzay (Ukraine) reported “Measurements of Self-Shielding Effects on  $^{52}\text{Cr}$  Isotope” which were measured with 24 keV neutron filtered beam at Kyiv Research Reactor.

#### (4) Environmental Studies

There are six talks to study environments by using neutron activation analysis. Four of them were from M. Frontasyeva’s laboratory in JINR. Two of them were from Slovakia.

M. Frontasyeva introduced the ongoing and future plans, i.e., “FLNP JINR Contribution to the European Programme “Atmospheric Heavy Metal Deposition”” and other three papers were the present activities: “Air Pollution Studies in Central Russia using Moss Biomonitors and Neutron Activation Analysis (E. Ermakova)”, “Monitoring of Heavy Metals and Radionuclides Air Pollution in the South Ural Mountains Using Mosses and Surface Soils”, and “Atmospheric Deposition of Trace Elements in Romania Studied by the Moss Biomonitoring Technique Using NAA and AAS (O. Culicov)”.

B. Mankovska from Slovakia introduced her project: “The use of Foliage of Forest Tree Species, Mosses, and Game as Biomonitors of Trace Element Deposition from the Atmosphere in Area of Aluminium Plant” and “Concentration of 25 Elements in the Foliage of *Populus tremuloides* Michx., *Betula papyrifera* Michx., and *Acer saccharum* Michx. Of the Three Localities with Different Ozone Level”.

#### (5) Ultracold Neutrons

Among nine talks, six are from Institute Laue-Langevin (ILL), Grenoble in France: “Small Changes in Energy of UCN in Traps and Interaction of Neutrons with Surface Nanoparticles (V. Nesvizhevsky)”, “General analysis of the DEDM experiment and a new advanced scheme (A. Petoukhov)”, “The Progress in methods and technique of polarized neutrons at ILL (A. Petoukhov)”, “Magnetic storage and cooling of neutrons and atomic hydrogen (V. Ezhov)”,

“Preparation of a new Neutron Lifetime Experiment (P. Geltenbort)”, and “Storage of UCN in a TRAPE made with Permanent Magnets (P. Geltenbort)”.

A. Barabanov from Kurchatov Institute presented “Inelastic Interaction of Ultracold Neutrons with Matter” which is the theoretical investigation of inelastic interaction of UCN with matter. V. Vasiliev from Institute for Theoretical and Experimental Physics give a talk on “Neutron Lifetime in Non-Uniform Magnetic Field”, where a method to determine the neutron lifetime with the help of decay electron counting from neutrons with gradual flux through a controlled region is proposed.

## May 30

### (6) Nuclear Structure

Eight papers were presented in this session. Six of them are related to the level density: “Nuclear Level Densities of  $^{90}\text{Nb}$  and  $^{94}\text{Nb}$  from Neutrons Evaporation Spectra (B. Zhuravlev, Obninsk, Russia)” showed the measurement of excitation functions, neutron spectra and angular distributions in (p,n) reaction on  $^{90}\text{Nb}$  and  $^{94}\text{Nb}$  measured in proton energy range of 7-11 MeV at the pulsed tandem accelerator EGP-15 of IPPE, Obninsk. Analysis of the measurements was carried out in the framework of statistical equilibrium and pre-equilibrium models of nuclear reactions.

“Level Densities and Radiative Strength Functions in  $^{171}\text{Yb}$  and  $^{170}\text{Yb}$  (A. Undraa, USA)” was showed the results for level densities and radiative strength functions from  $^{171}\text{Yb}(^3\text{He}, ^3\text{He}')$  reaction.

A. Sukhovej (JINR, Russia) was presented four papers: “Population of levels of  $^{183}, ^{187}\text{W}$  at  $E_{\text{ex}} < 3$  MeV by the  $\gamma$ -cascades”, “Two-step cascades from the  $^{117}\text{Sn}(n, 2\gamma)$  reaction and parameters of the  $\gamma$ -cascade decay of  $^{118}\text{Sn}$ ”, “Level Density and Radiative Strength Functions of Dipole  $\gamma$ -transitions in  $^{163}\text{Dy}$ ”, and “Estimation of the Value and Localization of Possible Systematic Errors in Determination of Level Density and Radiative Strength Functions from the (n,2 $\gamma$ ) Reaction”.

### (7) Theory

There are eight papers in this session. I just list them for references. “Quantum approach to the T-odd Asymmetry in the Angular Distributions of the Ternary Fission Products (V. Bunakov)”, “Mechanisms of Binary and Ternary Fission and P-odd and P-even Correlations (S. Kadmsky)”, “Calculations of the weak P-odd single-nucleon Hartree-Fock Potential with Various sets of Weak Meson-Nucleon Coupling Constants (V. Lyuboshitz)”, “Yields of fission fragments at transition

and intermediate energies (S. Yavshits)”, “Development of a Computer Code for Statistical Multistep Compound (SMC) and Direct (SMD) processes Calculations (C. Oprea)”, “Magnetic storage and cooling of neutrons and atomic hydrogen (V. Exhov)”, “Low Energy Nucleon Dynamics in the effective field theory of nuclear forces (R. Gainutdinov)”, and “Nonlocality of the NN Interaction in the effective field theory of nuclear forces (A. Mutygullina)”.

## Picnic

This is a traditional session held on the bank of Dubna River as a barbeque picnic starting at 4 PM. In this session, most of peoples are attended and lots of discussions, drinking (Vodka, wine, beer), eating, and sing a song. We are really enjoyed in this session. Some of peoples are going to bar in Dubna hotel after this picnic in order to continue more discussion (?). However, speakers for tomorrow’s session could not attend this kind of discussion.

## May 31

### (8) Fission

In this session, lots of peoples are still sleeping even he stayed in the session because of the picnic. Total thirteen papers are presented on this session. Six of them are experimental results and the rest of them are theoretical aspect on the fission process.

Yu. Kopatch reported the GSI results on “Multiparameter studies of spontaneous ternary fission of  $^{252}\text{Cf}$ ”. This experiment was aimed to improve the knowledge on the ternary fission process by investigating prompt neutron and  $\gamma$ -ray emission in coincidence with the fission fragments and light charged particles of various species.

V. Konovalov and V. Ketlerov reported the results from n\_TOF experiment of CERN on “Thermal Fission Cross section of U-234” and “FIC-0 Calibration Measurements at PTB”, respectively.

A. Laptev presented “Neutron induced fission cross-sections of  $^{240}\text{Pu}$ ,  $^{243}\text{Am}$ , and W in the energy range 1~200 MeV”. This measurement was done at the GNEIS facility of Petersburg Nuclear Physics Institute, Gatchina using a multiparticle ionization chamber and the time-of-flight technique on a 48-m flight path.

In addition to those oral presentations, there are two poster sessions on 28 and 29 and total twenty four papers were presented. The total numbers of oral presentations are sixty eight. Thus, ninety two presentations were reported in total. The reported results were measured at nine foreign facilities: PSI (Switzerland), GSI (Germany), Geel (Belgium), NIST Center for Neutron Research (US), FRM-II (Germany), n\_TOF (CERN), ILL (French), Pelletron facility of Titech

(Japan), and PNF (Korea). The experimental results from six or more facilities were presented: IBR-2 and IBR-30 in JINR, ITEP, Kurchatov Institute, IPPE (Obninsk), and GNESIS (PNPI). More details on ISINN-11 are in <http://isinn.dubna.ru/>.



Picture for Prof. Ro and author during the coffee break at ISINN-11