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*Nuclear and Particle Physics  
in Uzbekistan*





# Nuclear Facilities

Cyclotron U-150



Electron Accelerator –U003



Radio-Analytic Centre



Research Reactor 10MV



Gamma Facility



Neutron Generator



Izotope Laboratory



# Scientific Directions

**Nuclear Physics** – high energy physics, nuclear physics and nuclear technologies, physics of multi particle systems, interaction of nuclei and particles with matter, theory of nucleus, nuclear reactions at low energies, nuclear astrophysics, applied nuclear science.

**Radiation Physics of Solids and Physics of Nanomaterials** – radiation physics of metals, construction materials, semiconductors, dielectrics, ceramics, optical, composite and high temperature superconducting materials; crystal structure, radiation technologies, theory of defect states in crystals, radiation physics of nanostructure materials, physics of structure transformations in solids, physics of low dimension states;

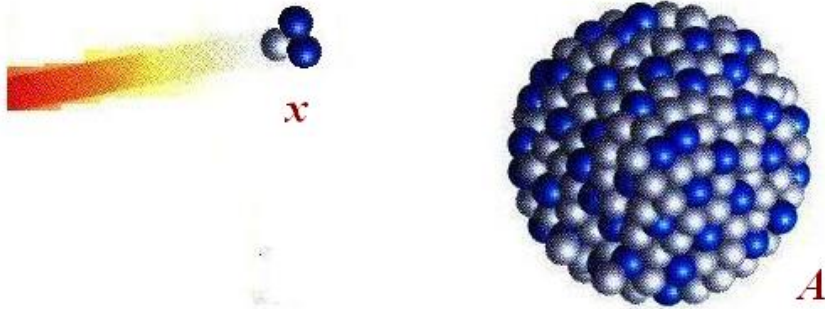
**Nuclear Analysis, General and Applied Radiochemistry** – applied nuclear analysis in material sciences, mining industry, agriculture, medicine, ecology; radiochemistry; radioisotope production, nuclear-physical methods for element analysis of objects and control of technological processes.

**Scientific Devices Design** – nuclear electronics, devices of radiation control for detecting radioactive and nuclear materials, complex systems of purity control, purification and disinfection of water, modeling of the ecology system, conditions of water and air basins.

# Low energies nuclear astrophysics (Uzbekistan-Kazakhstan-Italy-Poland-Russia-USA Collaboration)

*Peripheral interaction*

*Nucleon transferring reaction  $A(x,y)B$*



- *From the spectroscopic factor  $Z$  ( $B=A+p$ ) to the asymptotic normalization coefficient  $C$ .*

**S.V. Artemov et al.**

**Phys. At. Nucl. 59, 428 (1996):**

$A(3\text{He},d)B$ ,  $3\text{He}=d+p$  and

$B=A+p$ .

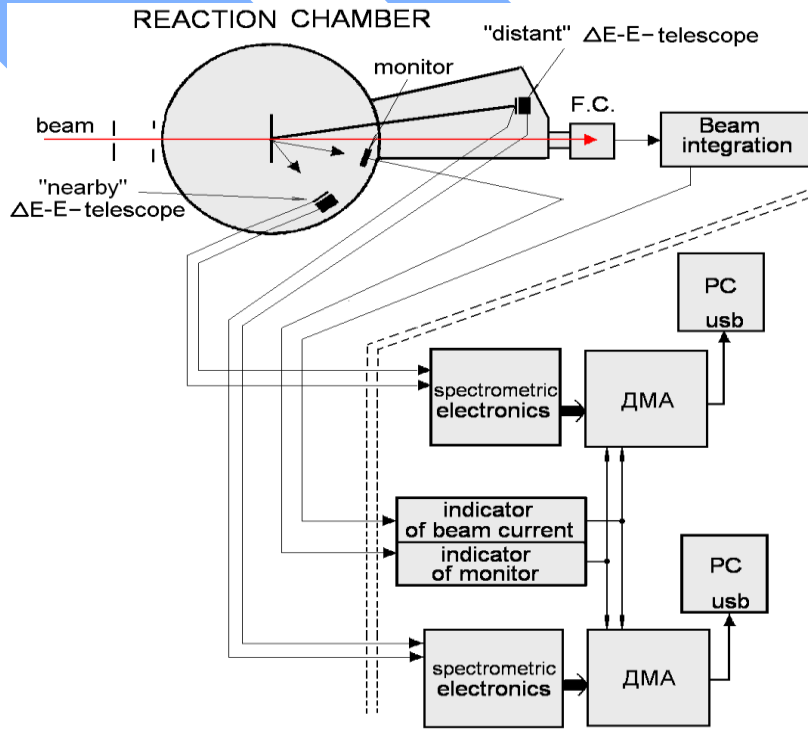
**S.Igamov, R.Yarmukhamedov,**

**Nucl.Phys. A 781(2007)247**

$A(p,\gamma)B$ ,  $B=A+p$ .



# Experimental set up based within the Uzbekistan-Kazakhstan collaboration

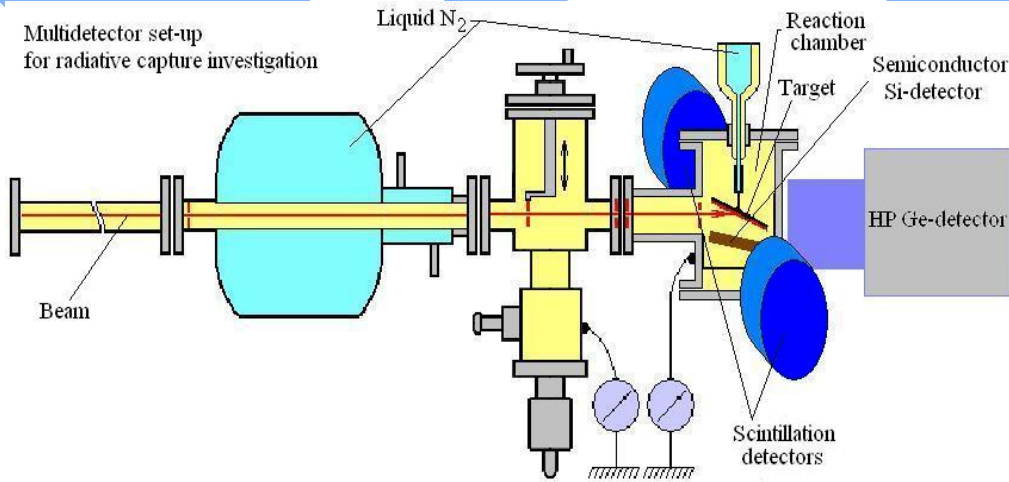


**С.В.Артемов и др.,**  
**ПТЭ, 2009, №1,с.168.**

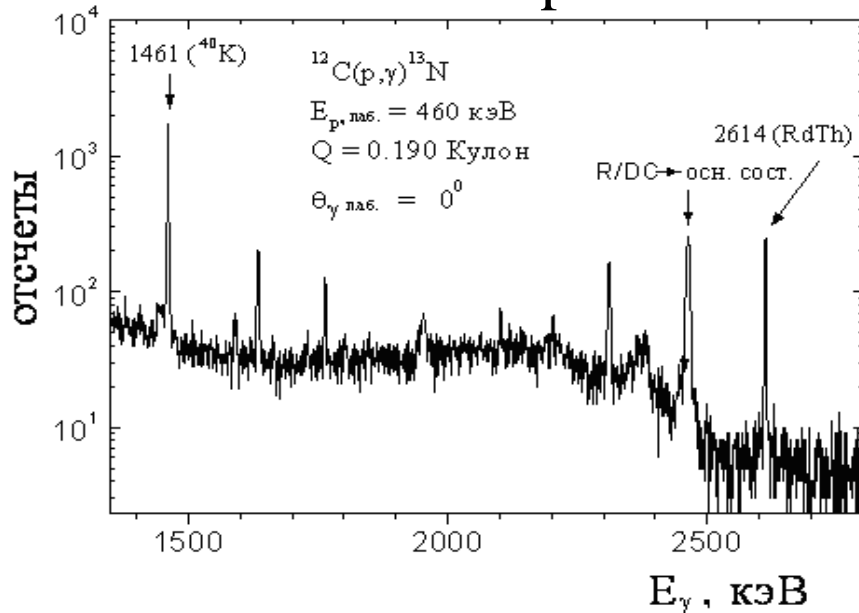
**V. Shevchenko, S.Artemov et al.**  
**IEEE Trans. on Nucl. Sci. 2007, 54,**  
**Issue 1 Part 2 p. 186**



# Direct measurements of the astrophysical S factors in Vande –Graff accelerator at the RIAP of The National university of Uzbekistan



Scheme of the set up



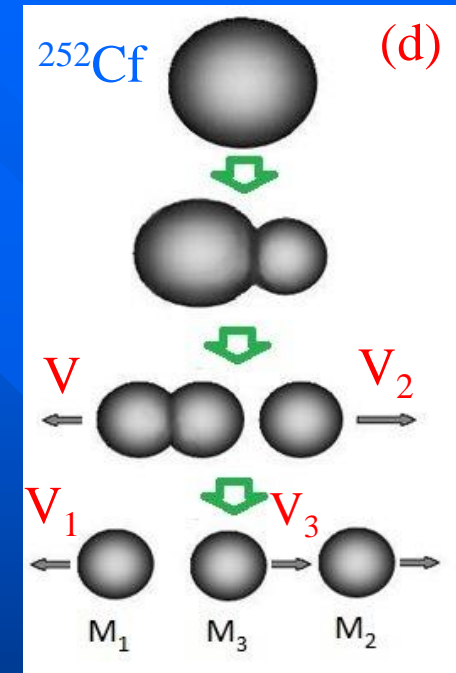
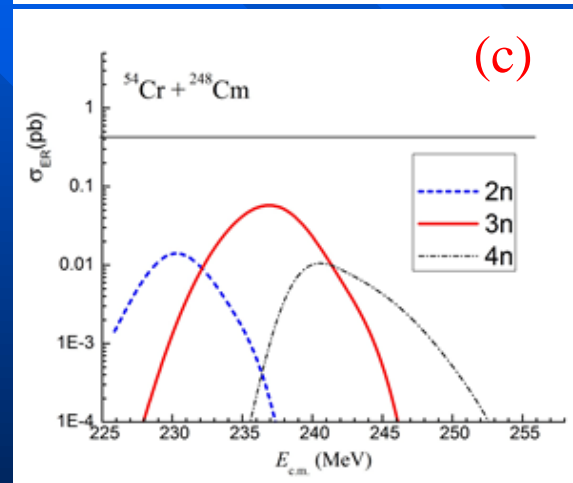
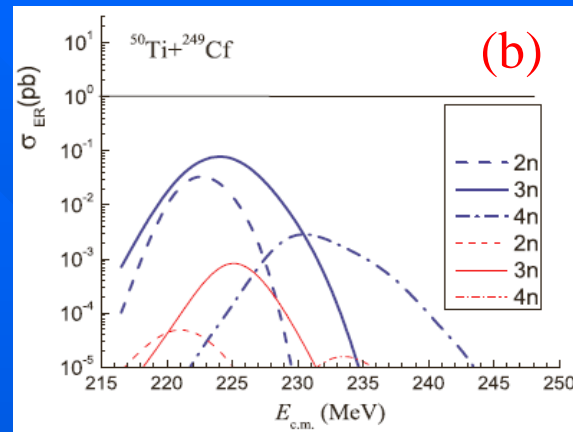
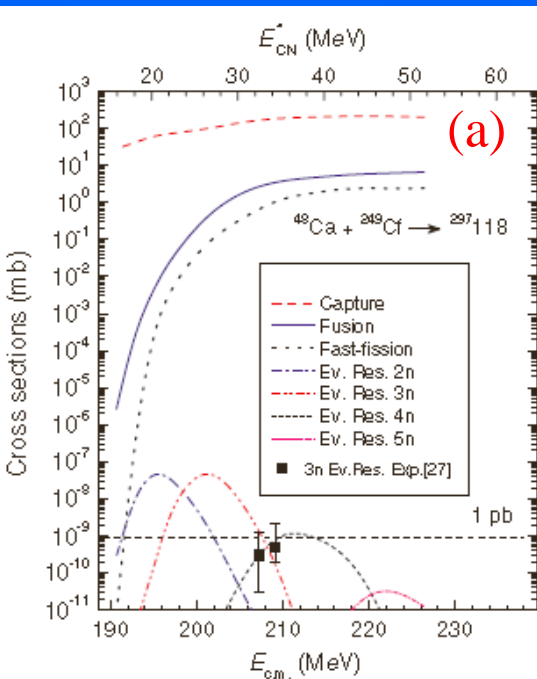
The multi-detectors set up,  
Vande –Graff accelerator.

# Results on nuclear astrophysics and a prospect

1. The asymptotic normalization coefficients (ANC) for  $^{14}\text{N} \rightarrow ^{13}\text{C} + p$  и  $^{15}\text{O} \rightarrow ^{14}\text{N} + p$ ;
2. The astrophysical S factor and ANC for the  $^7\text{Be}(p, \gamma)^8\text{B}$  reaction;
3. Astrophysical S factors for the reactions  $^{12}\text{C} + p \rightarrow ^{13}\text{N} + \gamma$ ,  $^{13}\text{C} + p \rightarrow ^{14}\text{N} + \gamma$ ,  $^{14}\text{N} + p \rightarrow ^{15}\text{O} + \gamma$  of the CNO-cycle.

*Direct precise measurements of  $d(\alpha, \gamma)^6\text{Li}$ ,  $^3\text{He}(\alpha, \gamma)^7\text{Be}$ ,  $^{12}\text{C}(p, \gamma)^{13}\text{N}$  and  $^{16}\text{O}(p, \gamma)^{17}\text{F}$  reactions data and their analysis are planned.*

# Synthesis of super-heavy elements and true ternary fission



Nasirov et al. Phys. Rev. C 79 (2009) 024606  
... synthesis of the 118th element.

A.K. Nasirov et al. Phys. Rev. C 84 (2011) 044612.  
... synthesis of element 120.

R.B. Tashkhodjaev, A.K. Nasirov, W. von Oertzen, Phys. Rev. C 91 (2015), 054612;

W. von Oertzen, A.K. Nasirov, B. Tashkhodjaev, Phys.Lett.B 746 (2015) 223.

# Applied nuclear physics

## *Nuclear radiation technology*

for ennobling semi-precious stones and various minerals for using in jewelry industry. The technology chain has been put into operation at the industry scale for radiation treatment of both natural raw stones and cut items, including import-export steps.





# *Technologies for obtaining labeled compounds and production of radioisotope goods:*



## *Cyclotron radionuclides:*

Co-57, Zn-65, Ga-67, Ge-68, Pd-103, Ce-139;

*Reactor radionuclides:* P-32, P-33, S-35, Cr-51, Mn-54, Fe-55, Co-58, Co-60, Mo-99, Y-90, I-125, I-131, Pm-147, Ta-182, W-188, Ir-192;

*Radionuclide generators:* Ge-68→Ga-68, Mo-99→Tc-99m, Sn-113→In-113m, W-188→Re-188.

*Immunofermental test systems* for determining the markers of viruses hepatitis B and C, and also AIDS.



## *Radiation technology for sterilization of various items*



Electron accelerator “Electronics – U-003” has been put into operation, its technical characteristics and beam parameters have been optimized.

The methods of radiation sterilization of pharmacy preparates, medical and other goods have been developed and implemented for services.