**Form № 21**

 **APPROVED BY**

 **JINR Vice Director**

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 “\_\_\_\_\_ “ \_\_\_\_\_\_\_\_\_\_\_ 2021

**SCIENTIFIC AND TECHNICAL JUSTIFICATION FOR OPENING ANEW THEME**

**ORFOR EXTENDINGTHEME**

**to be included in the**

**TOPICAL PLAN FOR JINR RESEARCH FOR2022-2023**

**Theme code** 02-1-1107-2011/2021 **Laboratory** Veksler and Baldin LHEP

 **Department** Scientific and Methodical№5

**Research area**Elementary Particle Physics and Relativistic Nuclear Physics (02)

**Theme title** [Development and Construction of the Prototype of a Complex for Radiotherapy and Applied Research with Heavy-Ion Beams at the Nuclotron-M](http://wwwinfo.jinr.ru/plan/ptp-2019/a911107.htm)

**Theme leader** S.I.Tyutyunnikov, deputy A.A.Baldin

**Abstract**

Creation of an experimental station on the beams of light nuclei of the Nuclotron-M to conduct experiments to obtain nuclear physics data during their interaction with the energy (1÷4.5)GeV/nuclei with micromodels of nuclear fuel assemblies in order to verify the programs used in the design of electronuclear facilities and neutron sources.

Creation of a set up for radiation testing of microelectronics and elements of superconducting devices of accelerators in order to study radiation effects in condensed matter under the action of relativistic particles.

**List of activities**

The theme includes the project "Research of deep subcritical electronuclear systems and possibilities of their application for energy production, transmutation of radioactive waste and research in the field of radiation material science" with the stages:

* data set during irradiation of a nuclear assembly with relativistic particles,
* radiation testing of microelectronics and elements of superconducting magnets

**Results expected upon completion of the theme**

The implementation of «Research of deep subcritical electronuclear systems and possibilities of their application for energy production, transmutation of radioactive waste and research in the field of radiation material science» project on the beams of the nuclei of the NICA complex will make it possible to obtain nuclear physical data for engineering calculations with the aim of creating a prototype of an electronuclear reactor.

To determine the radiation resistance of the materials used to create the NICA complex under the action of neutron beams and secondary particles, these materials will be irradiated (classical superconductors and HTSCs) with neutron beams, protons and other particles, as well as measurements of electrical and structural parameters will be carried out from dose characteristics, specific ionization losses.

**Participants from JINR**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Laboratory** | **№№** | **Name, Surname** | **№№** | **Name, Surname** |
| **LHEP** |  | **S.I. Tyutyunnikov** |  | **A.A. Baldin** |
|  |  | I.P. Yudin |  | E.G. Baldina |
|  |  | N.I. Zamyatin |  | P.R.Khariuzov |
|  |  | E.A.Levterova |  | A.P.Khariuzova |
|  |  | M.Paraipan |  | A.V.Beloborodov |
|  |  | A.I. Berlev |  | D.S.Korovkin |
|  |  | I.I.Mariin |  | A.B.Safonov |
|  |  | E.V. Strekalovskaya |  | E.V.Kostyukhov |
|  |  | V.N. Shalyapin |  | S.Yu.Starikova |
|  |  | V.A.Artiuh |  | Yu.A.Troian |
|  |  | S.V. Khabarov |  | A.Yu.Troian |
|  |  | A.V. Vishnesky |  | D.N.Bogoslovskiy |
|  |  | Yu.S. Kovalev |  | K.V.Mikhailov |
|  |  | M.Novikov |  | O.V.Belov |
|  |  | V.V.Efimov |  | V.V.Bleko |
| **FLNP** |  | M.Belova |  | M.Bulavin |
|  |  | G.M.Arzumanyuan |  |  |
| **LNP** |  | I.I.Adam |  | G.Khushvaktov |
|  |  | A.A. Solnyshkin |  | A.N.Fedorov |
|  |  | V.I. Stegaylov |  |  |

**Participating countries, institutes and organizations**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Country** **or Organization** | **City** | **Institute or Laboratory** | **Participants****Name, Surname** | **Status** |
| Armenia | Yerevan | YSUUniv. | A.Balabekian+2 | Protocol |
| Australia | Sydney | University | S.Khashemi-Nezhad+1 | Jointwork |
| Belarus | Minsk | INP BSU | Yu.FedotovaV.Baev+4K.Batrakov+4 | JointworkExchange of visits |
|  |  | JIPNR-Sosny NASB | I.Zhuk+4 | Joint workExchange of visits |
| Bulgaria | Sofia | INRNE BAS  | Ch.Stoyanov + 4 | Protocol |
| Czech Republic | Prague | CTU  | L.Zavorka+ 2 | Joint work  |
| Moldova | Chi§inau | ИПФ АНМ  | М.Baznat + 1  | Protocol |
| Mongolia | Ulaanbaatar | IPT MAS  | R.Toogoo + 2  | Protocol |
| Poland | Otwock-Swierk | NCBJ | M.Shuta + 4 M.Zelchinsky | Protocol |
| Russia | Dubna | “Omega” | V.Luzanov | Protocol |
|  |  | SINPMSU | T.Tetereva | Joint work |
|  |  | IPTP | A.A.SmirnovI.M.GazizovA.G.Letov | Protocol |
|  |  | Diamant | M.G.SapozhnikovP.P.ReunovYu.S.Rogov | Protocol |
|  | Moscow | GIHT RAS | V.P.Efremov + 4  | Joint work |
|  |  | “Maraphon” | A.S.Chepurnov + 3 | Joint work |
|  |  | ITEP SIC “Kurchatov institute” | T.V.Kulevoy, Titarenko Yu.E.+4 | Joint work |
|  | St.Peterburg | RI | S.IavshitsA.Smirnov+1 | Protocol |
|  | Tomsk | University | Yu.Pivovarov+4 | Joint work |
| Romania | Bucharest | ISS  | M.Khayduk + 4  | Protocol |
|    |    | UMF  | N.Verga + 2  | Joint work |
|    |    | IFIN-HH  | A.Dragolitch | Protocol |
|    | Baia-Mare | TUCN-NUCBM  | D.Rakolta | Protocol |
|    | Timishoara | UVT  | М.Bunoiu | Protocol |
|    | Яссы  | UAIC  | D.Mikhailesku + 3  | Protocol |
| Ukraine | Kharkov | NSC KIPT | V.Voronko+1V.Sotnikov+1 | Protocol |
| Uzbekistan | Tashkent | INPh | B.Yuldashev+3 | Protocol |

**Time frame of the themeof the project “Energy&Transmutation& Radiation material” Priority1 (2011-2022)**

**Total estimated cost of the theme**

|  |  |  |  |
| --- | --- | --- | --- |
| **№№** | **Activities** | **Total cost** | **Costs per years** **(thousandUSD)** |
| **(2022)** | **(2023)** |
|  | **Materialsandconsumables** | **0** | **0** | **0** |
| 3. | **Equipment** | **100** | **50** | **50** |
| **4.** | **Researchanddevelopment** | **0** | **0** | **0** |
| 5 | **Travelexpensesabroad** | **20** | **10** | **10** |
| 6 | **Travel expenses in rouble zone** | **20** | **10** | **10** |
| **Total** | **140** | **70** | **70** |

**Other financing sources**no

**Cost estimates for the theme**

|  |  |  |  |
| --- | --- | --- | --- |
| **№№****of items** | **Budget items** | **Total****2022–2023**  | **Including 2022** |
| **4** | **International collaboration** | 40 | 20 |
| **5** | **Materials** | 0 | 0 |
| **6** | **Equipment** | 100 | 50 |
| **10** | **Researchanddevelopment** | 0 | 0 |
| **Total** | 140 | 70 |

AGREED:

JINR ChiefScientificSecretary **Laboratory Director**

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**“ “ 2021 “ “ 2021**

**Head of Planning and Finance Department Laboratory Scientific Secretary**

 **/ \_\_\_\_\_\_\_/ / \_\_\_\_/**

**“ “ 2021 “ “ 2021**

**Head of Science Organization Department Laboratory Economist**

 **/ \_\_\_\_\_\_\_\_\_\_/ / \_\_\_\_/**

**“ “ 2021 “ “ 2021**

 **Theme leader / \_\_\_\_/**

 **“ “ 2021**