Guidelines and Blank for the Interim Report

For research projects which are funded for two or more years the Foundation expects yearly interim reports to be submitted both electronically (.doc/.docx or .pdf-file) **and** as a paper copy. Reports should be written in English, including an abstract in German, if the proposals were submitted in English.

The systematic evaluation of projects is of high importance for the development of the Foundation's funding initiatives; therefore, it is essential for the Foundation to receive comparable reports. Scientific publications are welcome but cannot replace a report. Please make use of the following blank. Some of the aspects listed may not be applicable to certain funding initiatives and may be omitted in those cases.

Front page	
Funding initiative	Between Europe and the Orient - A Focus on Research and Higher Education in/on Central Asia and the Caucasus
Reference number	AZ 93562
Title of the project	Regional Doctoral Program in Theoretical and Experimental Particle Physics
Project investigators and cooperation partners	Ulf-G. Meißner Akaki Rusetsky Thomas Mannel Andro Kacharava Mirian Tabidze Armen Nersessian

Narrative part of the report (which should not exceed 12 pages)

Report on scientific results and the progress achieved (approx. 2 – 4 pages)

2022 was the first year after the pandemic has receded, and one was able to resume the activities in person. The ongoing war in the Ukraine has, however, affected these activities. In this year, we had to exclude participants from Russia and Belarus from all our events.

2022 was the year of the consolidation of our previous achievements. A stable pool of master and PhD students continues to be formed, which starts to take a more active part in the activities of the collaboratiion that are not directly related on the work on the theses (e.g., in the outreach activities, see below). Moreover, 2022 was an year of the further expansion of our project. Namely, the Armenian node was extended and includes now also the researchers and students specialized in the experimental particle physics. Moreover, the Institute of Radiophysics and Electronics of Armenian Academy of Science (IRPhE) is part of the project now.

1. Below, we give a list of students that took part in the program. In 2022, five

of our students have successfully defended his PhD thesis.

YerPhI + YSU + IRPhE node:

Erik Khastyan,	PhD Student, Yerevan Physics Institute, ***RDP Stipend (since September 2018)***
Sergey Tumasyan,	***PhD Student, Yerevan Physics Institute,*** ***RDP Stipend (since September 2018)***
Gayane Ghevondyan,	PhD Student, Yerevan Physics Institute
Hazaravard Ghumaryan,	PhD Student, Yerevan Physics Institute
Aram Hayrapetyan,	PhD Student, Yerevan State University
Vigen Gareyan,	Master Student, Institute Radiophysics and Electronics
Maneh Avetisyan,	PhD Student, Yerevan Physics Institute, **Asatiani Stipend (since April 2018)**
Melik Karapetyan,	PhD Student, Yerevan Physics Institute ***Stipend by Armenian Committee of Science***
Mher Davtyan,	PhD Student Institute of Radiophysics and Electronics ***Stipend by Armenian Committee of Science***

Three PhD theses were defended in 2022 in Armenia:

Melik Karapetyan, PhD thesis:	PhD Student, Yerevan Physics Institute, *"Interacting Higher Spin theories in flat and AdS spaces"*
Supervisor:	Ruben Manvelyan (YerPhI) Defended at Yerevan Physics Institute 08.09.2022
Mher Davtyan, PhD thesis:	PhD Student, Institute of Radiophysics and Electronics *"The role of symmetrical inhomogeneity in problems of electromagnetic wave propagation"*
Supervisor:	Zhirayr Gevorkian (YerPhI & IRPhE) Defended at Yerevan State University 16.07.2022
Maneh Avetisyan	PhD Student, Yerevan Physics Institute, ***Asatiani stipend (since April 2018)***
PhD thesis:	*"Vogel's Universality and its Applications"*

Supervisor:	Ruben Mkrtchyan (YerPhI) Defended at Physics Institute 06.07.2022

TSU node:

Tamar Zakareishvili,	PhD student, Tbilisi State University, ***Asatiani stipend (since April 2018)***
Gogita Papaplashvili,	PhD student, Tbilisi State University, ***RDP Stipend (since April 2018)***
Revaz Beradze,	PhD student, Tbilisi State University, ***RDP Stipend (since February 2019)***
Alexander Gurchumelia,	PhD student, Tbilisi State University, ***RDP Stipend (since February 2019***)
Giorgi Kistauri,	PhD student, Tbilisi State University
Tinatin Supatashvili,	PhD student, Tbilisi State University
Mariam Abuladze,	PhD student, Tbilisi State University
Medea Abramishvili,	PhD student, Tbilisi State University

Two PhD theses were defended in 2022 in Georgia:

Tamar Zakareishvili,	PhD Student, Tbilisi State University, ***Asatiani Stipend (since September 2018)***
PhD thesis:	*"Studies of the ATLAS hadronic calorimeter performance and associated production of a top quark pair with a J/Psi meson"*
Supervisors:	Tamar Djobava (HEPI TSU) and Vakhtang Kartvelishvili (Lancaster University) Defended at Tbilisi State University 24.09.2022
Revaz Beradze,	PhD Student, Tbilisi State University, ***RDP Stipend (since January 2020)***
PhD thesis:	*"Some Cosmological and Astrophysical Implications of Mirror World Model"*.
Supervisors:	Merab Gogberashvili (TSU) and Zurab Berezhiani (L'Aquila University) Defended at Tbilisi State University 24.09.2022

Georgian and Armenian students at the University of Bonn:

Giorgi Chanturia,	PhD student from Georgia ***RDP stipend (since October 2021)***
Lado Razmadze, University of Bonn & Forschungszentrum Jülich	PhD student from Georgia, ***RDP stipend (since October 2018)***
Archil Suladze,	PhD student from Georgia, ***RDP stipend (since December 2020)***
Levan Iashvili,	Master student from Georgia since 01.10.2021, ***RDP stipend (since October 2021)***

Georgian and Armenian students at FZJ:

Natia Beriashvili,	Master Student from Georgia, GTU

2. We continued to deliver advanced lecture courses.

YerPhI + YSU +IRPhE node:

"Lectures on experiments&experimental techniques in high energy particle physics (HEP)" by Gevorg Karyan (YerPhI).

TSU node:

“Modern Trends in Mathematical Physics II” by Gia Giorgadze (TSU)

3. For the first time, a public lecture for the secondary school students **“Transition from the Classical to Quantum Physics”** was held by the PhD students at the University of Bonn Giorgi Chanturia (via the Zoom platform). This is the first occasion, when our students take part in the outreach activities related to delivering of the lectures. We find this fact extremely important,

since an ultimate goal of the whole project is to prepare a pool of young academics that will eventually replace the existing scientific cadre in Georgia and Armenia. Hence, an involvement of our PhD student in the teaching in their home country is a development in the right direction, and we are going to support such activities in the following.

Furthermore, two public lectures were given by Akaki Rusetsky (University of Bonn), again via the Zoom platform. The first one, entitled **“The symmetries in Nature and their Violation”** was given for Georgian bachelor students, and the second one, “**The physics of the Void”** (together with Prof. Gia Dvali from LMU Munich), addressed the general audience during the Tbilisi Architectural Biennale.

There have been considerable outreach activities by the Georgian and Armenian nodes as well, which are reflected in numerous publications in media, see below.

4. 2022 was the year where our traditional PhD School and Workshop “Recent Advances in Fundamental Physics” was held in person after two years of the online format caused by the pandemic. As usual in the last years, it has been very representative and has hosted many students from the region, namely, Armenia, Azerbaijan and Iran (as noted previously, the Russian and Belarussian participants were excluded). It should be especially noted that out of six lectures three were held by the representatives of the Georgian scientific diaspora who currently work at the Universities of Munich, l’Aquila and Sydney. This fact is a nice demonstration of a constantly growing involvement of the scientific diaspora in the education processes in home countries, which was a main aim of our project. Furthermore, the workshop that followed the PhD school was very representative, with well-known experts from ten countries being among the participants. More information can be found at the conference website (see below).

In addition, two more workshops have been co-organized in the framework of our project:

International Conference on Quantum Magnetism and Statistical Mechanics of Lattice Models, May 11-15 (2022), Yerevan, Armenia

Caucasian-German School and Workshop: Health as a Global Challenge: Contributions by GGSB SMART|Labs, 12-16 September (2022), Tbilisi, Georgia

The links to the websites of these events can be also found below

5. The purchasing of the equipment for the TSU laboratory has been continued in 2022. The laboratory is functioning.

6. In 2021 we got involved in a new project TSU STEM Junior University (the website is only in Georgian), which aims at the popularization of physics among secondary school students. Within this projects, nine popular lectures were held in 2022, one of them by our student Giorgi Chanturia (University of Bonn).

7. Both female physicists, which were recipients of Tina Asatiani stipend: Maneh Avetisyan (Armenia) and Tamar Zakareishvili (Georgia) have defended their PhD theses in 2022.

8. We are continuing attracting additional external support for our projects. For example, the TSU STEM Junior University is financially supported by TSU and SRNSF.

Self-evaluation in comparison with the original objectives and working plan (e.g. unexpected results, other deviating developments in terms of contents/methodology)

2022 has shown that the project has recovered already at the pre-pandemic level and continues to function. Among the new developments one should stress a participation of our students in the activities of the project (like the outreach activities). In the future, we plan to put more focus on such developments, involving selected students in the planning of the activities and project management (to a certain extent). The reason of this is twofold. First, it will help them to develop scientific leadership skills, necessary for the successful academic career. Second, this will strengthen ties between the students educated at German Universities, and the Universities in their country of origin that will facilitate the process of the scientific return.

To summarize, we thing that the project has mainly achieved its goals in 2022

Added value gained through interdisciplinary and international cooperation

Our project is a rare example of a cross-border cooperation in the war-torn region. This is particularly important amid the events in the Ukraine that will trigger (is already triggering) avalanche of changes in the region and brings forward the necessity of horizontal alliances between countries, free of malign Russian domination. From this point of view, our project can be considered as a (small) step in the right direction.

Public relation activities and resonance in the media

Popular lecture by Giorgi Chanturia (University of Bonn) "Transition from the classical to quantum physics“ given at STEM Junior University on December 7 (online).

Popular lecture by Akaki Rusetsky (University of Bonn) "Physics of the void," given together with Prof. G. Dvali at Tbilisi Architectural Biennale on October 13 (online)

Popular lecture by Akaki Rusetsky (University of Bonn) "Symmetries in Nature and their violation," given for the project Speech.ge on October 22 (online)

Armen Nersessian, “Вклад в Науку по числу публикаций или как там у вас с

индексом Хирша” Interview to „Golos Armenii“ newspaper, 10 June 2022.

Maneh Avetisyan, “Кто научит одаренных?” Interview to "Golos Armenii" newspaper, 28 September June 2022

Conference on Quantum Magnetism and Statistical Mechanics of Lattice Models, May 11-15, 2022, Yerevan, Armenia dedicated to 70th anniversary of Nerses Ananikyan was reflected here:

https://fb.watch/hqIgVCC9-6/

https://youtu.be/c8Uuel7PlJQ

https://www.aanl.am/departuse.php?control=i1346&pc=210&lang=

https://fb.watch/hqI_uHPh9U/

https://fb.watch/hqJ2a975ux/

Workshop Collisions 2022, TSU newspaper:

https://tsu.media/fizika-urtiertqmedebebshi-simpoziumi/

PDP PhD School & Workshop, TSU news: https://www.tsu.ge/ka/event/3826

IX CGSWBS Workshop, TSU news: https://www.tsu.ge/ka/event/3829

Further aspects (e.g. particularly beneficial or obstructive circumstances, experiences with cooperation)

The implementation of the project has proceeded smoothly in 2022, without major human-created obstructive circumstances.

Tabular part of the report	
Participating researchers and students, separated by institution and funding source	Given on a separate sheet
Additional cooperation partners in the project (not applicants)	

Publications and abstracts directly related to the project (Please include reprints.)	Given on a separate sheet. Only one paper, co-authored by students, is not available in free online repositories. The reprint of this paper is attached as a file armenia1.pdf.
Specific events, e.g. workshops (Program, list of participants, abstracts and other details may be appended in a separate file.)	International Conference on Quantum Magnetism and Statistical Mechanics of Lattice Models, May 11-15, 2022, Yerevan, Armenia Caucasian-German School and Workshop: Health as a Global Challenge: Contributions by GGSB SMART|Labs, 12-16 September, 2022, Tbilisi, Georgia School and Workshop "Recent Advances in Fundamental Physics, September 24 - October 1, 2022, Tbilisi, Georgia
Patents directly related to the project	none