

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION  
Federal State Autonomous Educational Institution of  
Higher Education  
"Ural Federal University named after the First President of Russia B.N. Yeltsin"

Institute of Natural Sciences and Mathematics

APPROVED BY  
Vice-Rector for Research  
A.V. Germanenko  
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**PROGRAM OF THE DISCIPLINE**

**Research practice**

<b>List of information about the program of the discipline</b>	<b>Credentials</b>
<b>Postgraduate Program</b> Space physics, astronomy	<b>Code PP</b> 1.3.1.
<b>Group of specialties</b> Physical sciences	<b>Код</b> 1.3.
<b>Federal State requirements (FSR)</b>	Order of the Ministry of Science and Higher Education of the Russian Federation № 951 dated 20.10.2021.
<b>Self-approved requirements (SAR)</b>	Order "On the implementation of the "Requirements for the development and implementation of training programs for scientific and scientific-pedagogical personnel in the graduate school of UrFU" dated 31.03.2022 №315/03

**Ekaterinburg**  
**2023**

The program of the Research practice was compiled by the authors:

<b>№</b>	<b>Name</b>	<b>Degree, Academic Title</b>	<b>Position</b>	<b>Affiliation</b>
1	Anton I. Vasyunin	PhD	Associate Professor	Department of Astronomy, Geodesy, Ecology and Environmental Monitoring of the Institute of Natural Sciences and Mathematics
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**Recommended by:**


**Educational and methodological board of Institute of Natural Sciences and Mathematics**

Head of the Educational and Methodological board of  
the Institute of Natural Sciences and Mathematics  
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E. S. Buyanova

**Agreed by:**

Head of academic staff training department

  
E.A. Butrina

## **1. GENERAL CHARACTERISTICS OF THE DISCIPLINE RESEARCH PRACTICE**

### **1.1. Annotation of the discipline content**

The purpose of the discipline: the consolidation and deepening of postgraduate students' theoretical knowledge obtained during the study of special disciplines, as well as the acquisition of research skills.

The content of the research practice of a postgraduate student is determined taking into account the interests and capabilities of the department where it is carried out, and is completely determined by an individual task. The list of questions that graduate students study and perform in practice, their detail and depth of study, as well as the nature of individual tasks are determined by the head of the practice.

The main objectives of the research practice are:

- learning the basics of scientific work;
- development of practical skills and abilities of scientific activity;
- strengthening motivation for scientific work;
- acquaintance of graduate students with the specifics of scientific activity in the field of the studied specialty;
- formation of skills necessary for a researcher;
- consolidation of scientific and methodological knowledge in the field of disciplines on the studied specialty;
- acquiring the skills of a creative approach to solving scientific and production problems.

### **1.2. The language of the discipline implementation – English.**

### **1.3. Planned learning outcomes by discipline**

As a result of mastering the discipline, a graduate student should:

#### **Know:**

- information on the organization of scientific work in a higher educational institution,
- a holistic view of scientific activity, research teams and the structure of the scientific community in higher education;
- the main achievements and trends in the development of the relevant subject and scientific area and its relationship with other sciences;
- the main scientific journals of the relevant subject and scientific field;
- legal and regulatory framework for the functioning of scientific activities;
- the procedure for implementing the main provisions and requirements of documents regulating the activities of the university, department, teaching staff to improve scientific work on the basis of the Federal State Educational Standards;
- real problems and tasks solved by research teams of institutions of higher professional education;

#### **Be able to:**

- use scientific technologies, methods and techniques for carrying out scientific research;
- use the subject material and the relationship of scientific disciplines for the presentation of the scientific research results;
- use the possibilities of attracting their own scientific research as a means of improving the educational process;
- use computer technology and information technology for scientific activity;
- analyze the reasons for successes and failures in scientific activities, adjust their scientific activities.

#### **Own:**

- methods of using technical means in conducting scientific research;
- methods of oral and written scientific speech;
- skills of registration of results of scientific researches;
- methodology and technology of scientific research and scientific experiment;
- methodology for self-assessment and self-analysis of the results and effectiveness of scientific research.

#### 1.4. Practice base

The base of the research practice is FSAEI HE “Ural Federal University named after the first President of Russia B.N. Yeltsin”. The organizer of the research practice is the department of the Institute of Natural Sciences and Mathematics, to which the postgraduate student is assigned. If necessary, a graduate student can undergo research practice at other departments similar in terms of scientific work, especially if the scientific interests of the department and the topics of the research work of the graduate student coincide.

During the period of practice, the graduate student obeys all the internal regulations and safety regulations established at the departments and other departments of the university in relation to the scientific and production process.

General management of scientific practice and scientific and methodological consulting is carried out by the supervisor and/or head of practice.

#### 1.5. The structure of practices, their terms and duration

№	Type of practice	Academic semester number	Scope of Practice	
			weeks	credit points
1.	Research practice	2	2	3
<b>Total</b>			2	3

#### 1.6. Scope of Practice

№	Types of educational work	Scope of discipline		Distribution of the volume of discipline in the 2nd semester (hours)
		Total hours	Incl. contact work (hour)	
1.	<b>Self-swork of graduate students, including all types of current attestation</b>	<b>108</b>		<b>108</b>
2.	<b>Midterm assessment</b>	<b>Test</b>	<b>0.25</b>	<b>Test, 4</b>
3.	<b>Total volume according to the curriculum, hour.</b>	108		108
4.	<b>Total volume according to the curriculum, credit points</b>	3		3

## 2. DISCIPLINE CONTENT

The code section, topic	Section, topic of disciplines	Content
1	Organizational aspects of scientific activity	Organization of scientific activity in the Russian Federation, in the education system of the Russian Federation and in UrFU. Directions of scientific activity of the graduating department, leading professors and associate professors of the INSMa's departments. The history of the formation of the directions of scientific activity of the graduating department, other INSMa's departments. The study of literature on the problems of scientific creativity. Drawing up an individual plan for research practice.
2	Oral and written scientific speech	Methods for organizing oral presentation at scientific seminars, conferences, etc. Methods for organizing written scientific texts in the preparation of the

		<p>results of research in the form of reports, articles, abstracts, presentations, monographs, popular science texts, etc.</p> <p>Methods for developing scenarios for conducting scientific teleconferences and other innovative forms of scientific knowledge exchange.</p> <p>Participation in scientific seminars.</p>
3	Practical aspects of scientific work	<p>Legal and regulatory foundations of scientific activities.</p> <p>Methods for assessing the quality of scientific activity and scientific publications.</p> <p>Analysis of domestic and foreign practices of training scientific specialists.</p> <p>Acquaintance with the experience of various scientific seminars and scientific schools of the Institute of Natural Sciences and Mathematics.</p> <p>Acquaintance with the scientific equipment existing at the university, computer programs, and the possibilities of technical means.</p> <p>Methods of preparation and carrying out scientific research and experiments.</p> <p>Attendance at scientific and methodological consultations.</p> <p>Preparation of the research practice mastering's report</p>

### 3. ORGANIZATION OF PRACTICAL STUDIES, INDEPENDENT WORK ON THE DISCIPLINE

#### 3.1. Sample plan for self-study

List of tasks for self- study	Labor intensity	
	hour	Credit points
Organization of scientific activity in the Russian Federation, including in universities. Organization of scientific research in UrFU.	4	
Directions of scientific activity of the graduating department, leading professors and associate professors of the INSMa's departments.	4	
The history of the formation of the directions of scientific activity of the graduating department, other INSMa's departments	4	
The study of the literature on the problems of scientific creativity	3	
Drawing up an individual research practice plan	3	
Methodology of organizing oral scientific speech at scientific seminars, conferences, etc.	4	
Methods for organizing written scientific texts in the preparation of the results of research in the form of reports, articles, abstracts, presentations, monographs, popular science texts, etc.	10	
Methods for developing scenarios for conducting scientific teleconferences and other innovative forms of scientific knowledge exchange	6	
Participation in scientific seminars	16	
Legal and regulatory foundations of scientific activities	6	
Methods for assessing the quality of scientific activity and scientific publications	4	
Analysis of domestic and foreign practices of training scientific specialists	6	
Acquaintance with the experience of various scientific seminars and scientific schools of the Institute of Natural Sciences and Mathematics	4	
Acquaintance with the scientific equipment existing at the university, computer programs, and the possibilities of technical means	12	
Methods of preparation and carrying out scientific research and experiments	10	
Attendance at scientific and methodological consultations	6	
Preparation of the research practice mastering's report	6	
<b>Total</b>	<b>108</b>	<b>3</b>

#### 4. FUND OF EVALUATION FACILITIES FOR CURRENT AND INTERIM CERTIFICATION ON THE DISCIPLINE

##### 4.1. Criteria for evaluating the results of control and evaluation activities of the current and intermediate certification in the discipline

Approved by the Institute criteria for evaluating the achievements of graduate students for each control and evaluation event. The system of assessment criteria is based on three levels of development of competency components: threshold, advanced, high.

Competency components	Signs of the level of mastering the components of competencies		
	threshold	advanced	high
<b>Knowledge</b>	A graduate student demonstrates knowledge-acquaintance, knowledge-copy: he recognizes objects, phenomena and concepts, finds differences in them, shows knowledge of the sources of obtaining information, can independently carry out reproductive actions on knowledge by self-worthy reproduction and application of information.	A graduate student demonstrates analytical knowledge: he confidently reproduces and understands the acquired knowledge, assigns it to one or another classification group, independently systematizes it, establishes relationships between them, and applies it productively in familiar situations.	A graduate student can independently extract new knowledge from the world around him, creatively use it to make decisions in new and non-standard situations.
<b>Skills</b>	A graduate student is able to correctly perform prescribed actions according to an instruction, an algorithm in a known situation, independently performs actions to solve typical problems that require a choice from among known methods, in a predictably changing situation	A graduate student is able to independently perform actions (techniques, operations) to solve non-standard tasks that require a choice based on a combination of known methods in an unpredictably changing situation	A graduate student is able to independently perform actions related to solving research problems, demonstrates the creative use of skills (technologies)
<b>Personal qualities</b>	A graduate student has a low motivation for learning activities, shows an indifferent, irresponsible attitude to learning, assigned work	A graduate student has a pronounced motivation for learning activities, demonstrates a positive attitude towards learning and future work, and is active.	The graduate student has a developed motivation for learning and work activities, shows perseverance and dedication, diligence, independence, and creativity.

##### 4.2. Evaluation tools for current and intermediate certification

The final document is a written report of the postgraduate student, which should reflect the sections in accordance with the practice program and the presentation of the results of the practice at a meeting of the department in the form of a report.

In the report, the graduate student must reflect the results of the research and trials in which he participated. In the case of an internship in scientific organizations or enterprises, the head of the organization (enterprise) evaluates the quality of the report and, taking this into account, gives a review of the postgraduate student's work. The signature of the head of practice from the organization (enterprise) in the report is certified by the seal of the personnel department.

Attestation of a graduate student based on the results of practice is carried out by the department where he underwent research practice, based on the submission of a review by the head of the practice. The main basis for attestation of a graduate student is the active participation of a graduate student in the work of scientific seminars on the subject of his research work.

A graduate student who has not completed the internship program, or who has received an unsatisfactory grade during the defense of the report, is sent to practice again during the holidays.

## **5. EDUCATIONAL AND INFORMATION SUPPORT OF DISCIPLINES**

### **5.1. Recommended literature**

#### **5.1.1. Main literature**

1. Tamhane, A. C. Statistical Analysis of Designed Experiments: Theory and Applications. 1 ed.; Wiley- Interscience: 2009; p 720.
2. Herzog, M. H.; Francis, G.; Clarke, A. Understanding Statistics and Experimental Design. Springer Cham: 2019; p 142.
3. Moon-Earth-Sun: The oldest three-body problem.  
<http://sites.apam.columbia.edu/courses/ap1601y/Moon-Earth-Sin%20RMP.70.589.pdf>
4. Introduction to Space Physics. [https://mcgoodwin.net/pages/spacephysics\\_ess471.pdf](https://mcgoodwin.net/pages/spacephysics_ess471.pdf)
5. Astrometry. [http://ircamera.as.arizona.edu/Astr\\_518/astrometry\\_2016.pdf](http://ircamera.as.arizona.edu/Astr_518/astrometry_2016.pdf)
6. Introduction to Astrometry. [https://pholus.mtk.nao.ac.jp/~toshio/education/Astrometry\(Note-BW\).pdf](https://pholus.mtk.nao.ac.jp/~toshio/education/Astrometry(Note-BW).pdf)
7. Astronomy2e. <https://openstax.org/details/books/astronomy-2e>
8. Introduction to Optical Telescopes. <https://rwoconne.github.io/rwoconne/astr1230/telescopes.html>
9. Large Optical Telescopes. <https://vdoc.pub/documents/the-design-and-construction-of-large-optical-telescopes-6171ci7f13i0>
10. Basics of Radio Astronomy. [https://www2.jpl.nasa.gov/radioastronomy/radioastronomy\\_all.pdf](https://www2.jpl.nasa.gov/radioastronomy/radioastronomy_all.pdf)
11. Review of Neutrino Astronomy. <https://arxiv.org/pdf/astro-ph/0204527.pdf>

#### **5.1.2. Additional literature**

1. Booth, W. C.; Colomb, G. G.; Williams, J. M.; Bizup, J.; Fitzgerald, W. T. The Craft of Research. 4 ed.; University of Chicago Press: 2016; p 336.
2. Thomas, G. How to Do Your Research Project: A Guide for Students. 4 ed.; SAGE Publications Ltd: 2022; p 368.
3. Silvia, P. J. How to Write a Lot: A Practical Guide to Productive Academic Writing. 2 ed.; American Psychological Association: 2018; p 110.
4. Bright Wilson Jr., E. An Introduction to Scientific Research. Dover Publications: 1991; p 400.
5. Dunleavy, P. Authoring a PhD: How to Plan, Draft, Write and Finish a Doctoral Thesis or Dissertation. Red Globe Press: 2003; p 297.
6. Schimel, J. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded. Oxford University Press: 2011; p 221.
7. McCarthy, P.; Hatcher, C. Presentation Skills: The Essential Guide for Students (Study Skills). 1 ed.; SAGE Publications Ltd: 2002; p 228.
8. Morgan, S.; Whitener, B. Speaking about Science: A Manual for Creating Clear Presentations led.; Cambridge University Press: 2006; p 138.

### **5.2. Methodological developments**

Not provided

### **5.3. Software**

1. Microsoft office (Word, Excel, Power point)
2. Google Chrome
3. Adobe Reader
4. Software package GILDAS: <http://www.iram.fr/IRAMFR/GILDAS/>
5. Software package IRAF: <http://iraf.noao.edu/>

6. Software package SAOImage DS9: <http://ds9.si.edu/site/Home.html>
7. Software package OrbFit: <http://adams.dm.unipi.it/~orbmaint/orbfit/>
8. Publishing system MiKTeX: <https://miktex.org>

#### **5.4. Databases, information and reference and search systems**

1. ScienceDirect: <http://www.sciencedirect.com>;
2. Web of Science: <http://apps.webofknowledge.com>;
3. Scopus: <http://www.scopus.com>;
4. Reaxys: <http://reaxys.com>;
5. Search engine EBSCO Discovery Service <http://lib.urfu.ru/course/view.php?id=141>;
6. Federal Institute of Industrial Property <http://www1.fips.ru>;
7. Intelligent search engine Nigma RF (Нигма.РФ). access mode: <http://www.nigma.ru>.
8. Russian electronic scientific library: <http://www.elibrary.ru>
9. Search engines for publications of domestic and foreign scientific publications: <http://www.sciencedirect.com>, <http://www.ingentaconnect.com>
10. Astrophysical Data System, [http://adsabs.harvard.edu/abstract\\_service.html](http://adsabs.harvard.edu/abstract_service.html)
11. Astronet, <http://www.astronet.ru>
12. VisieR Data Sastem, <http://vizier.u-strasbg.fr/viz-bin/VizieR>
13. Astrochemistry Data System KIDA, <http://kida.obs.u-bordeaux1.fr/>

#### **5.5. Electronic educational resources**

1. Zonal Science Library <http://lib.urfu.ru>;
2. Library catalogs <http://lib.urfu.ru/course/view.php?id=76>;
3. Digital catalogue <http://opac.urfu.ru>;
4. Electronic library systems <http://lib.urfu.ru/mod/resource/view.php?id=2330>;
5. Electronic resources of free access <http://lib.urfu.ru/course/view.php?id=75>;
6. Electronic resources by subscription <http://lib.urfu.ru/mod/data/view.php?id=1379>.

## **6. MATERIAL AND TECHNICAL SUPPORT OF THE DISCIPLINE**

### **6.1. Information about the equipment of the discipline with specialized and laboratory equipment**

Ural Federal University has special rooms for lecture-type classes, group and individual consultations, current control and intermediate certification, as well as rooms for independent work, equipped with computer equipment with the ability to connect to the Internet and provide access to the electronic information and educational environment and facilities for storage and preventive maintenance of equipment. Postgraduate students of the departments are provided with special rooms for research work.