Multidisciplinary age-diverse popular-science program using virtual observatory (VO) and space flight simulation for deep immersion in uptodate topics of space exploration, rocketry, astrophysics, space engineering, space biology and medicine

space-school.org

Project Roadmap

2015 - 2019: ~50 students taking part in single panel on space exploration and rocketry

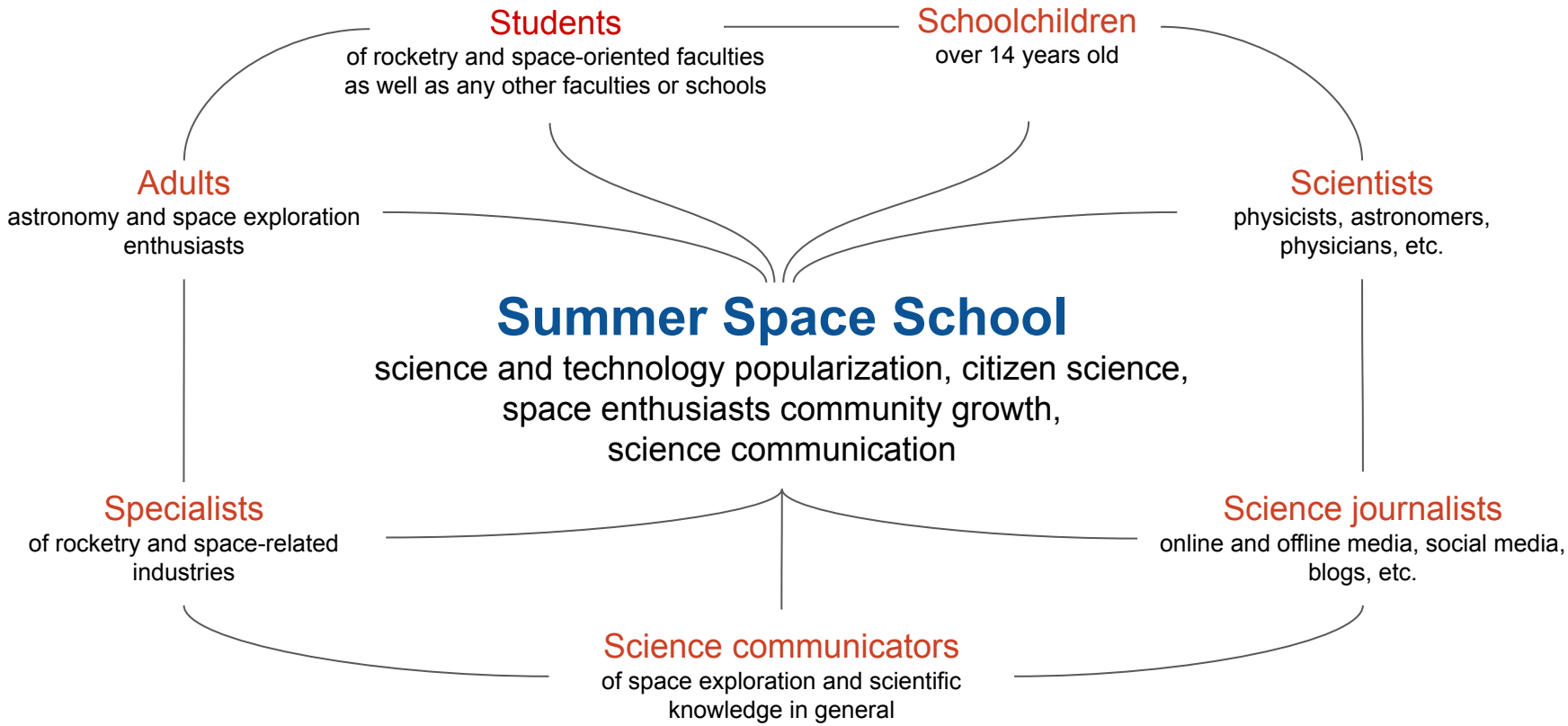
2020: 100 students taking part in three panels

2021: Summer Space School for 100-120 students, five panels, specialized session in children's camp for 50 students, participation in space related festivals

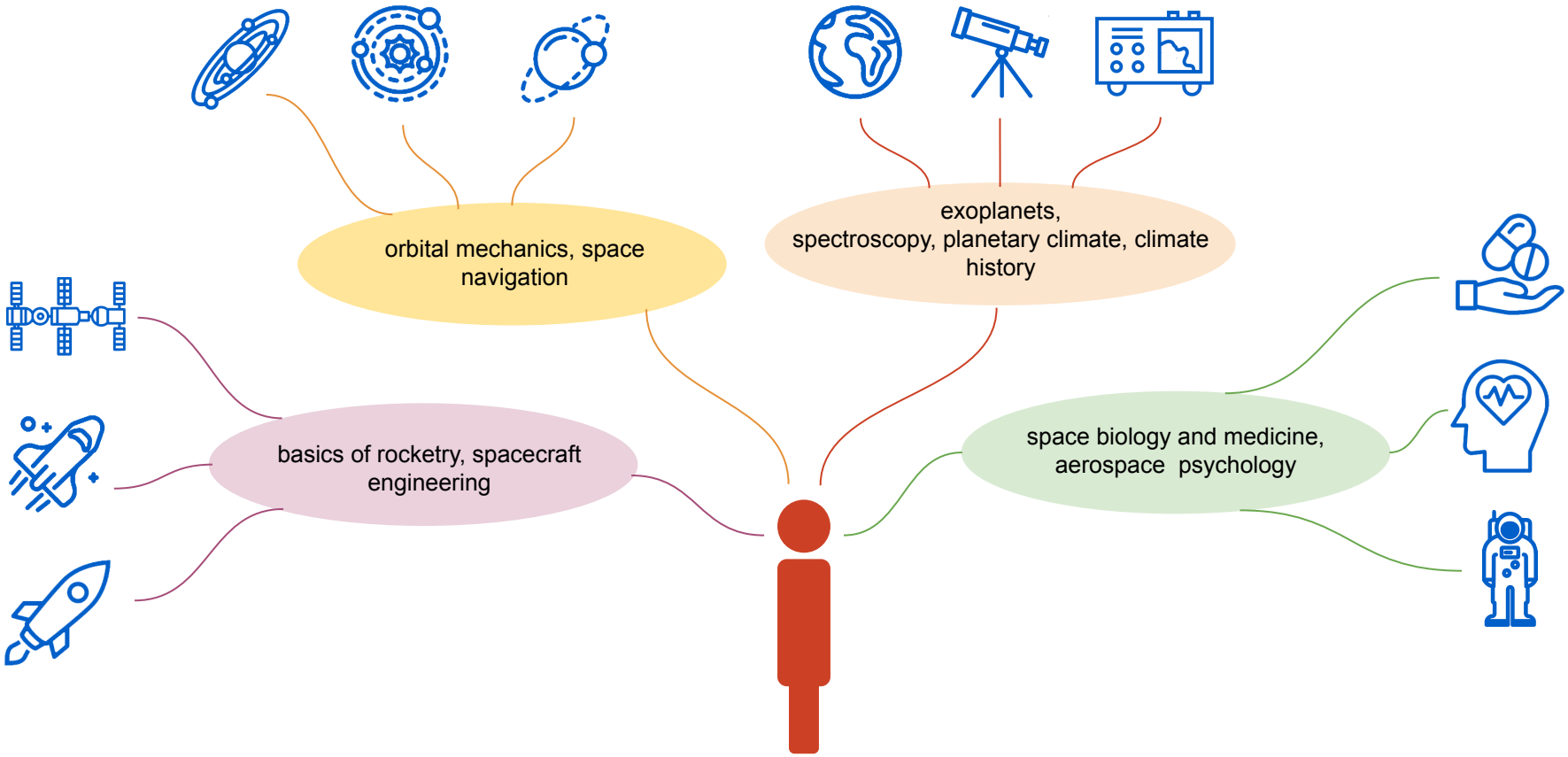
2022: Summer Space School for 100-150 students, five panels, "soft science" space school, specialized sessions in children's camps, space related festivals

2023: and further annual international Summer Space School for 200-250 students, seven panels, specialized sessions in children's camps, space related festivals, full-time offices in Russian regions

Intercommunication platform for scientists, science communicators and space enthusiasts



What can be achieved within a week?



Building a comprehensive view on the world

- Changing the perception of new information: news, movies and media, books, etc.
- Quick introduction to the area of interest
- Choice of profession
- Maintaining interest in the chosen area of activity

Key Feature of Summer Space School: Space Flight and MCC Simulation

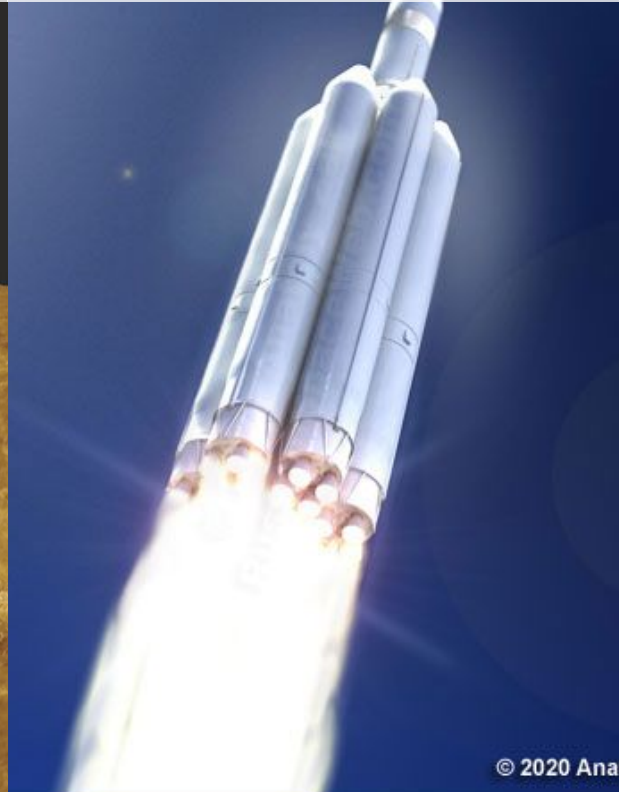
- Kerbal Space Program — simulation core
- KSP TOT — space missions trajectory calculation and optimization tool
- Orbital mechanics and flight control training program
- Various space flight simulation scenarios

Various Space Flight Simulation Scenarios

Scenario #1: simulation of lunar operation with landing on the surface

Scenario #2: simulation of flyby trajectory mission Earth, Venus, Mars

Scenario #3: simulation of expedition to Mars with landing and activities on the surface



Virtual Observatory (VO)

Simulation participants → **Virtual Tools**

Synthetic Data:

- NASA Planetary Spectrum Generator
- Климатическая модель специальной разработки

Public Database:

- National Snow and Ice Center
- NOAA's National Centers for Environmental Information

National Centers for Environmental Information

Theoretical and practical studies sealed with simulation of space flight

Theory

lectures from real scientists and industry experts, tours to space-oriented museums

Practice

practical lessons with volunteers and master classes with mentors

Simulation

application of the acquired knowledge and skills in a virtual environment without the help of mentors

Knowledge
Skills
Personal experience

Summer Space School –2021

ЛКШ·2021
ЗВЁЗДНЫЙ ПУТЬ
Звёзды ближе, чем ты думаешь

Skolkovo
Institute of Science
and Technology

Skoltech

Skolkovo Institute of Science and Technology

July 31 - August 8, 2021

Summer Space School −2021

75 participants

17 volunteers

50 lecturers

10 tutors

2 VIP guests:

- Dmitry Rogozin
- Ivan Vagner (cosmonaut)

ЛКШ·2021
ЗВЁЗДНЫЙ ПУТЬ
Звёзды ближе, чем ты думаешь

July 31 − August 8, 2021

24 hours of lectures

46 hours of panel sessions

31 hours of practical studies and master-classes

147 hours of total duration

July 31 – August 8, 2021

Partners of Summer Space School–2021

АНО **РАДИАНТ** | **Skoltech**

with the support of **РОСКОСМОС**

СТРАТОНАВТИКА
ОПЕРАТОР СТРАТОСФЕРНЫХ ПОЛЁТОВ

ИМБП

ИКИ

ТВОЙ
сектор космоса

МАКД

СЕВАСТОПОЛЬСКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ

ОБРАЗОВАНИЕ БУДУЩЕГО

ТРАЕКТОРИЯ
ФОНД ПОДДЕРЖКИ НАУЧНЫХ, ОБРАЗОВАТЕЛЬНЫХ И КУЛЬТУРНЫХ ИНИЦИАТИВ

КОСМИЧЕСКИЙ РЕЙС

ОТКРЫТЫЙ КОСМОС

АМКОС
АССОЦИАЦИЯ МУЗЕЕВ КОСМОНАВТИКИ РОССИИ

Orbital Express

АНО Альпина нон-фикшн
думай по-своему!
nonfiction.ru

СОЛА
Симферопольское общество любителей астрономии

3D FLY

Новинки

SciTeam
наука

ГУРБЕЙ
ЗОЛОТО

Congressplus

MAN-MADE CUSTOM SOLUTIONS

СПУТНИКС

Program for Summer Space School −2021

- studying exoplanets remotely and in situ
- human spaceflight
- satellite mega-constellations
- role of human in space exploration

Astrophysics:
spectroscopy of planetary atmospheres, climate modeling, climate studies

Cosmonautics:
orbital mechanics, trajectory planning and optimization, piloting and manual docking

Space communications & Distant Sensing:
spacecraft engineering, satellite mega-constellations control, ground segment of space communications, remote sensing methods

Space biology and medicine:
human in space, the impact of spaceflight on the psyche and health, isolation experiments, experiments on the ISS and in deep space

Meetings:
- with a cosmonaut
- with a practicing ballistician
- with science journalists
- with radio astronomy enthusiasts

Tours:
- Institute of Space Research Museum
- Khrunichev Space Research Center Museum
- Rocket and Space Corporation Energia Museum
- Cosmonautics and Aviation Centre, VDNH

Space Flight Simulation:
- interstellar expedition
- control of an interplanetary expeditionary complex
- study of spectra
- study of paleoclimate in VR lab
- communication sessions with spacecraft
- medical experiments with real equipment

Cosmonautics Panel

Head of Panel:

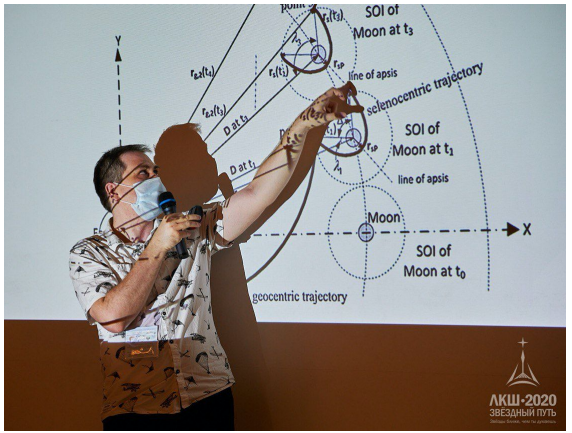
- Sergey Lemeschenko - Summer Space School CTO, author of the idea of space flight simulation and Mission Control Center.

Theory:

- Orbital Mechanics Basics
- Orbital maneuvers
- Trajectory planning and optimization
- Piloting in simulation
- Manual docking

Practice:

- Building satellites constellations with certain orbital parameters
- Orbital maneuvering missions
- Creation and optimization of flight scenarios using KSP TOT
- Mastering management of space complexes in simulation
- Practicing manual docking skills on the simulator



Space Communications and Distant Sensing Panel

Mentors:

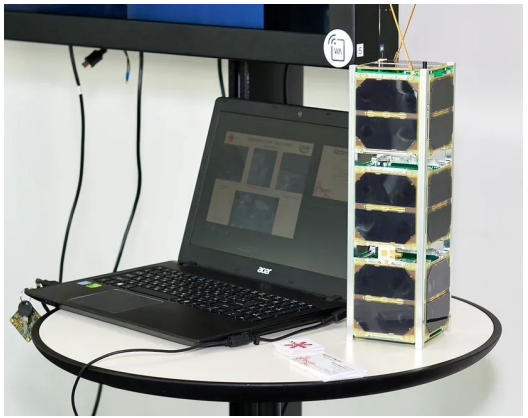
- Dmitry Pashkov (R4UAB.ru)
- Denis Golikov (SPUTNIX)

Theory:

- Arrangement of spacecraft systems
- Spacecraft constellation control
- Software development for aerospace applications
- Application of VR technologies in space engineering
- Remote sensing of the Earth and use of remote sensing data

Practice:

- Manufacture of antennas of different types
- Receiving telemetry and satellite images
- Working with the OrbiCraft-Pro 3U Educational set
- Workshop on satellite control in the Orbit program



СПУТНИКС

ОБРАЗОВАНИЕ БУДУЩЕГО

ИКИ

Astrophysics and Geophysics Panel

Head of Panel:

- Alexander Lomakin - Post-Graduate Student, Space Research Institute of the Russian Academy of Sciences, faculty member of Moscow Institute of Physics and Technology

Theory:

- Infrared spectroscopy of planetary atmospheres
- Climate modeling
- Methods for studying the history of climate
- Study of marine sediments and ice cores
- Space weather

Practice:

- Working with synthetic spectral data
- Workshop on determining the speed of rotation of the Sun
- Examining ice core analysis data in a VR lab

ИНСТИТУТ ГЕОГРАФИИ
Российской академии наук
основан в 1918 году

ИНСТИТУТ ОКЕАНОЛОГИИ РОССИЙСКОЙ АКАДЕМИИ НАУК

ИНАСАН
Институт астрономии РАН

ИКИ

Skoltech

Space Biology and Medicine Panel

Key Partner of the Panel:

- The Institute of Biomedical Problems (IBMP) of the Russian Academy of Sciences

Theory:

- Human in space
- Space psychology
- Space experiment technique
- Radiation in space
- Isolation experiments

Practice:

- “Content” experiment: remote monitoring of intra-group and inter-group interaction based on a meaningful analysis of communication between the crew and the Mission Control Center
- “Homeostasis” experiment: assessment of the leadership qualities of team members and their ability to make coordinated decisions
- “Algometry” experiment: study of human pain sensitivity during space flight
- “Pilot-T” experiment: study of reliability of an astronaut’s professional activity in a long-term space flight
- “Cardiovector” experiment: study of influence of space flight factors on the spatial distribution of heart rate energy

Science Journalism Panel

Head of Panel:

- Mikhail Kotov - scientific and military journalist, popular science communicator, author of publications in N + 1, Popular Mechanics, Forbes, Vedomosti, Vzglyad, Meduza and Profile

Theory:

- Features of scientific journalism
- Working with information sources and their verification
- Various publishing formats
- Working with social networks
- Working with press releases

Practice:

- Writing news and stories under the guidance of mentors
- Managing a telegram channel by making stories about the course of the School
- Media coverage of spaceflight simulation during School

Summer Space School as research collaboration catalyst

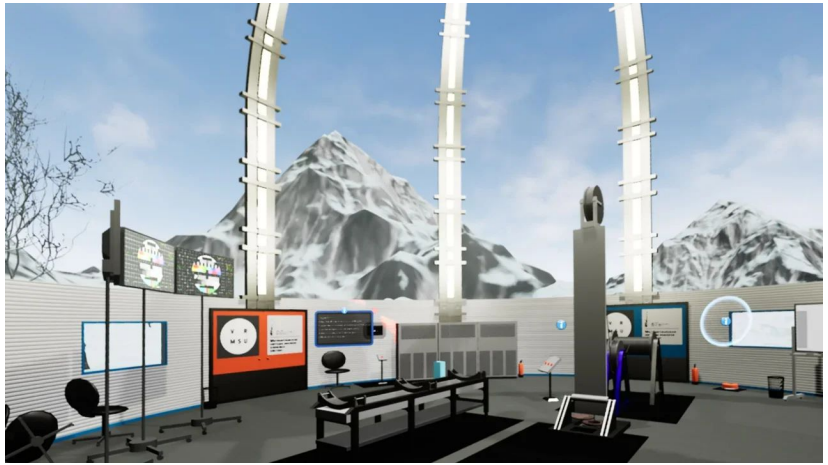
VR Lab:

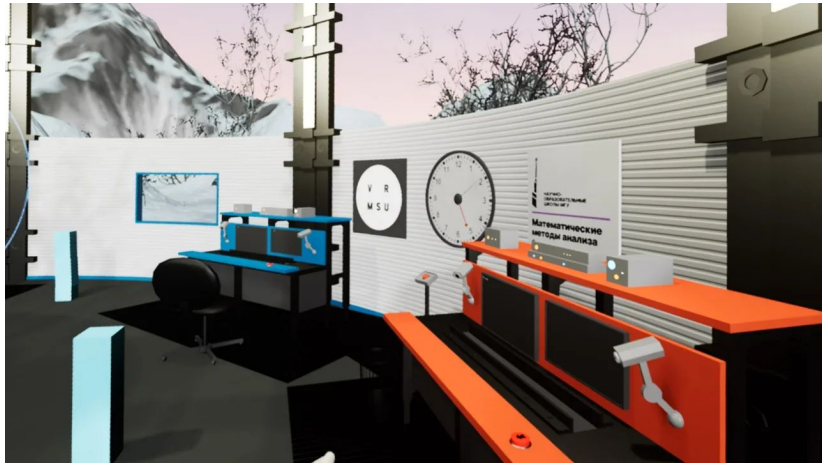
- Demonstration of the ice drilling process
- Extracting and preparing ice cores
- Two stations for core analysis
- 10 minutes of duration

ААНИИ

V R
M S U

НАУЧНО-ОБРАЗОВАТЕЛЬНЫЕ ШКОЛЫ МГУ
Математические методы анализа сложных систем





Interaction of scientists and enthusiasts as part of citizen science

An excerpt from the report on the work of the employees of the laboratory of psychogenetics of the Institute of Psychology of the Russian Academy of Education at Summer Space School - 2020. The School participants were subjects in the experiment and also learned how to take EEG measurements themselves:

The main task of conducting a psychophysiological study within the Summer Space School 2020 was to compare the functional state of school participants in a state of resting wakefulness (resting state) and in a situation of mastering new skills in the process of modeling a space flight. To assess the psychophysiological state, the EEG method was chosen. EEG was recorded using a mobile 64-channel encephalograph Cognionics-HD, with a sampling rate of 500 Hz. Methods of analysis of current source density (CSD), spectral analysis using Fourier transform, as well as visual analysis of EEG were used.

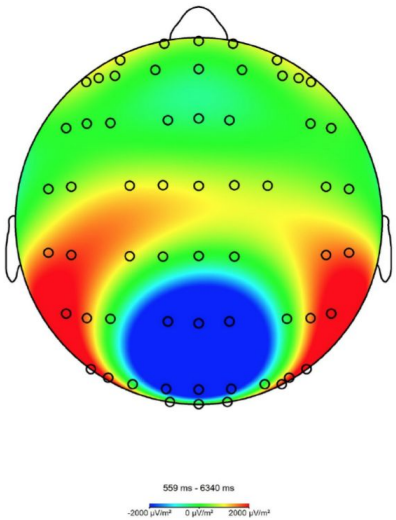


fig. 4. Topographic analysis of the current source density in resting state
Maximal activity is observed in occipital regions

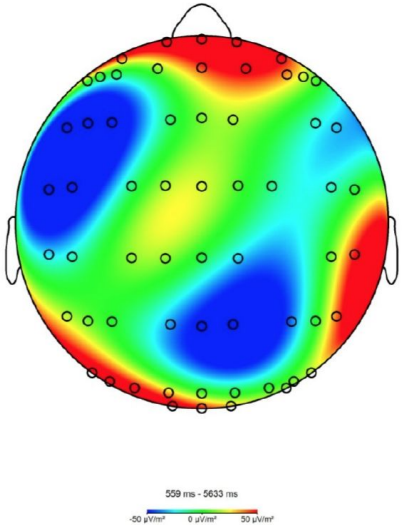


fig. 5. Topographic analysis of the current source density in arousal state
Dynamic reorganization of brain activity associated with development of new skills

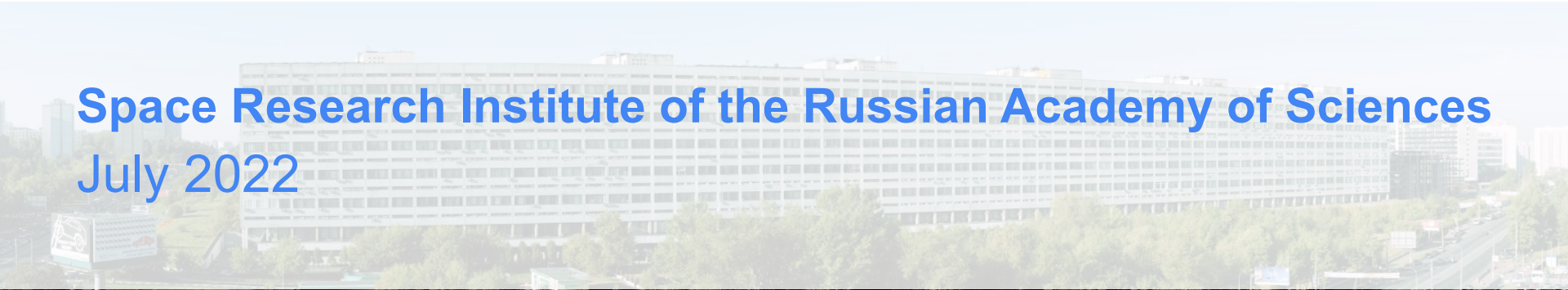
Summer Space School −2022

Topics:

- Mars and Moon exploration
- In situ resource utilization
- Human spaceflight
- Human in space
- The role of human in space exploration

Panels:

- cosmonautics
- astrophysics and planetology
- space communications and remote sensing
- space biology and medicine
- science journalism



Space Research Institute of the Russian Academy of Sciences

July 2022

Find More about Summer Space School on

- Website: space-school.org
- E-mail: info@space-school.org
- Youtube “SummerSpaceSchool”
- Vkontakte: vk.com/summer_space_school
- Facebook: facebook.com/spaceschool2021
- Instagram: instagram.com/summer_space_school