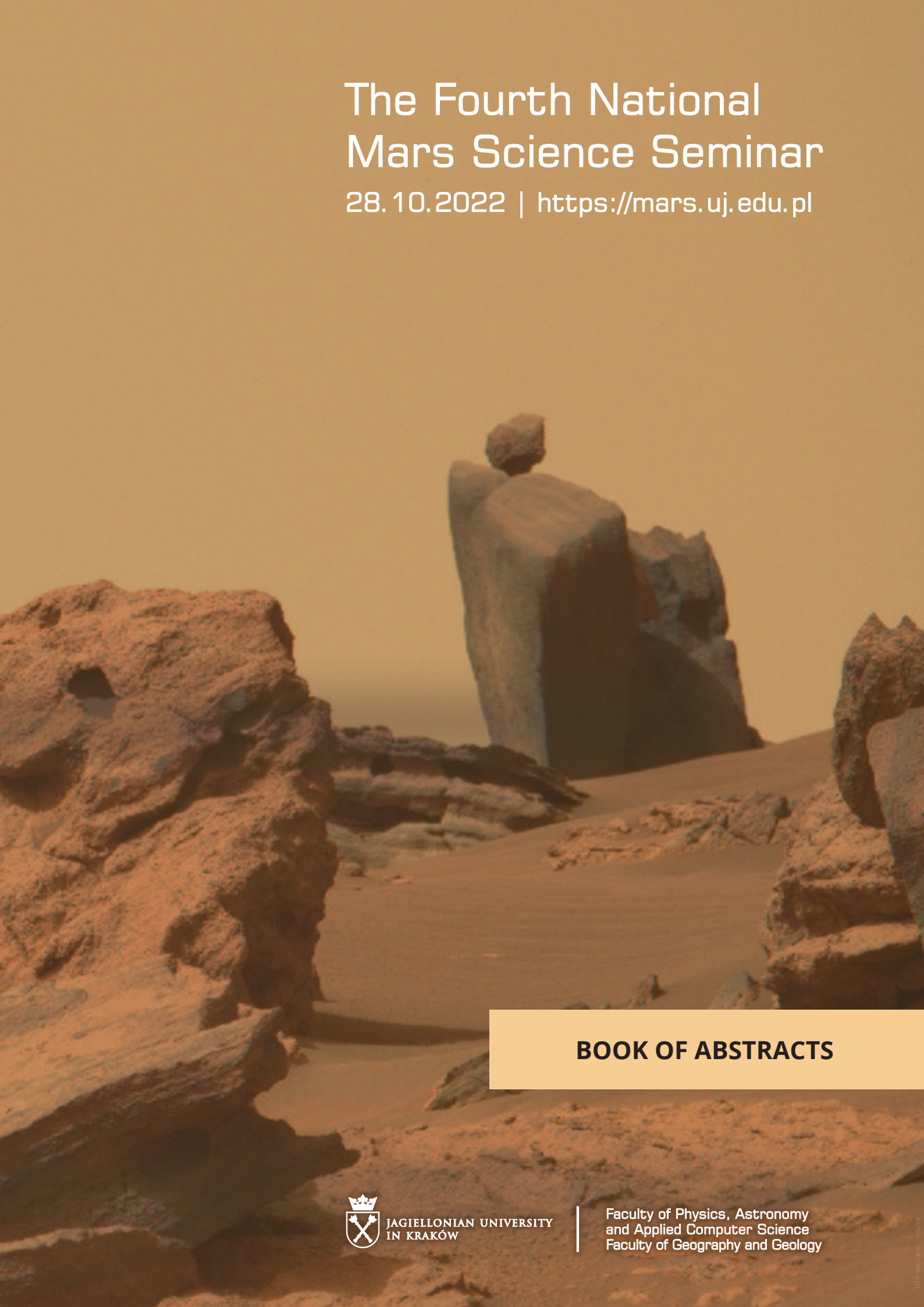
The Fourth National Mars Science Seminar

28.10.2022 | https://mars.uj.edu.pl



BOOK OF ABSTRACTS

JAGIELLONIAN UNIVERSITY IN KRAKÓW

Faculty of Physics, Astronomy and Applied Computer Science
Faculty of Geography and Geology

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PROGRAM

9:30-10:00 Registration (Main Hall)

10:00-12:00 Oral Session (Room A-1-06)

10:00-10:10 Opening of the Fourth National Mars Science Seminar

10:10-10:30 Robert Olszewski (Warsaw University of Technology)
Modeling the modification process of Mars' atmosphere using hexagonal cellular automata

10:30-10:50 Joanna Kozakiewicz (Jagiellonian University in Kraków)
Forced ripples on Mars

10:50-11:10 Joanna Gurgurewicz (Space Research Centre PAS)
Serpentinization and listwanitization of ultramafic rocks in Ladon basin, Mars

11:10-11:30 Anna Łosiak (Insitute of Geological Sciences PAS)
What terrestrial very small impact craters can tell us about similar features on Mars

11:30-11:50 Magdalena Baranowska (Adam Mickiewicz University in Poznań)
Mapping features potentially related to glacio-volcanic activity in Utopia Planitia, Mars

11:50-12:00 Overall discussion and closing of the Oral Session

12:00-12:15 Break

12:30-13:15 Poster Session (II floor corridor at room A-1-06)

Paweł Wajer (Space Research Centre PAS)
The science of ExoMars 2016 mission

Maciej Kania (Jagiellonian University in Kraków)
Geometry and topology of a lineament network in selected areas of Meridiani Planum, Mars - preliminary results

Natalia Zalewska (Space Research Centre PAS)
Some remarks about Martian „blueberries" and spherical concretion from Utah

Leszek Czechowski (Space Research Centre PAS, University of Warsaw)
Modeling of selected Martian geomorphological structures in the laboratory

13:15-14:15 Lunch (Bar in Main Hall)

14:15-15:45 Workshop (Room F-1-04)

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Modeling the modification process of Mars' atmosphere using hexagonal cellular automata

Prof. Robert Olszewski
Warsaw University of Technology

The presentation will discuss the concept and prototype of a system that allows numerical modeling of changes in the atmosphere of Mars relevant to the terraformation process of this planet. The modeling process uses hexagonal cellular automata of varying size and iterative simulation calculations. The author will present different variants of the increase in temperature and pressure of Mars' atmosphere related to the modeling of the greenhouse gas release process and the controlled impact of a nitrogen-rich asteroid.

The work was funded by POB Research Centre Cybersecurity and Data Science of Warsaw University of Technology within the Excellence Initiative Program - Research University (ID-UB).

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Forced ripples on Mars

Dr Joanna Kozakiewicz
Jagiellonian University in Kraków

Ripples, sand ridges formed by wind perpendicular to their crests, are the most common bedforms on Mars. Ripples were previously classified in terms of their composition into two categories: fine-grained and coarse-grained ripples. We have found that this classification is insufficient, and ripples need to be divided also in terms of their apparent formation environment into free ripples and forced ripples, as these two types of bedforms evolve differently and are characterized by different properties. Forced ripples are created by non-free flow, i.e., fluid flow instabilities related to topographic obstacles, and are always larger and often of more complex structure than nearby free ripples formed by free flow (fluid flow not influenced by topography). In this study, a developed classification of ripples is presented and the formation and evolution of fields of forced ripples is discussed.

The work was funded by the Anthropocene Priority Research Area budget under the program „Excellence Initiative – Research University" at the Jagiellonian University.

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Serpentinization and listwanitization of ultramafic rocks in Ladon basin, Mars

Dr Joanna Gurgurewicz
Centrum Badań Kosmicznych Polskiej Akademii Nauk

The evolution of the Ladon basin has been marked by the discharge of huge volumes of water from the Martian highlands to the lowlands in the late Noachian and Hesperian. Our study area displays younger dark lobate flows which were likely extruded from a regional fracture network. Spectral analysis suggests that these flows and the underlying terrains have an ultramafic composition. Stratigraphically below the lobate flows is a yellowish alteration level. Its spectral signature indicates serpentinization of the underlying ultramafic rocks. It includes hundreds of structurally controlled narrow ridges which are reminiscent of ridges of listwanite, a suite of silicified, fracture-controlled silica-carbonate assemblage of hydrothermal origin observed in terrestrial ophiolites. Serpentinization and listwanitization probably result from the thermal effect of the overlying ultramafic flows on an Hesperian aquifer. East Ladon may host the first listwanite ridges ever described on Mars.

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What terrestrial very small impact craters can tell us about similar features on Mars

Dr Anna Łosiak
Institute of Geological Sciences, Polish Academy of Sciences

Asteroids are constantly colliding with Earth and Mars regularly forming new impact craters. On Earth a new crater is formed up to a couple times per millennium (e.g., Carancas in 2007 in Peru, or Sikhote Alin craters in 1947 in Peru). Based on the extrapolation of the currently measured impact rate of small bodies at the top of the atmosphere, we expect >20 craters ~100 m in diameter in Holocene alone. On Mars impact crater formation rate is higher due to the proximity to the asteroid belt, and a thinner atmosphere that decelerates impactors less. As a results, more than 700 sites at which new impact craters formed were discovered within the last few decades (since orbiting spacecraft first began imaging Mars). The environment around very small impact craters on Earth is modified by the impact, including local and short-term heating of the selected section of the sediments. Similar process is likely to happen on Mars leading to modification of its surface.

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Mapping features potentially related to glacio-volcanic activity in Utopia Planitia, Mars

BSc Magdalena Baranowska
Adam Mickiewicz University

Utopia Planitia is major depressions in Northern Plains, filled with Hesperian and Amazonian fluvial and periglacial sediments. The basin is covered with structures related to water presence like channels, polygons, thumbprint terrain or buried craters. Some of the observed structures still do not have a defined origin and might have been related to the endogenetic origin. Here we show distribution and properties of a previously not mapped feature with an unknown origin present within a NW sector of Utopia: low elevation mounds. We mapped 131 low elevation mounds identified. Their diameter ranges between 1 km to 7,3 km and have height from 5 to 65 m. Morphologically low elevation mounds can be divided into 3 types: Fractured mounds with distinct crack at the top of mound; Cratered mounds, with summit covered with sub-circular features; Smooth mounds, covered with dark material, do not show any particular features on their surface. Low elevation mounds resemble pingos or mud volcanoes.

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The science of ExoMars 2016 mission

Dr Paweł Wajer
Centrum Badań Kosmicznych Polskiej Akademii Nauk

[POSTER]

The European-Russian ExoMars Trace Gas Orbiter (TGO) has been in scientific orbit since 2018. This orbiter consists of four scientific instruments: ACS (Atmospheric Chemistry Suite), CaSSIS (Colour and Stereo Surface Imaging System), FREND (Fine Resolution Epithermal Neutron Detector) and NOMAD (Nadir and Occultation for MArs Discovery). The main scientific goals of TGO are detection and characterization of trace gasses, searching for their sources and sinks, as well as studying their seasonal and spatial variations. It also image and characterize surface of the Mars. These images may be useful in characterizing sources and sinks of certain atmospheric trace gases. One of the most interesting subjects of investigation is the appearance and disappearance of methane (CH4) on short timescales. The study of the possible trace gases sources/sinks and their transport in the atmosphere is one of the objectives of our research. This leads to develop the Martian atmosphere model, with the production and the transport of major as minor species of the atmosphere.

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Geometry and topology of a lineament network in selected areas of Meridiani Planum, Mars – – preliminary results

Dr Maciej Kania
Jagiellonian University in Kraków

[POSTER]

In the vicinity of the Opportunity Rover traverse on the Meridiani Planum HiRISE photos reveal areas of extensive lineament networks. We manually digitized these networks in four selected sectors and performed geometrical and topological analysis with the NetworkGT QGis toolbox. In total, 4046 line features were traced in 4 sectors. The analyze sectors were: A1 - around and to the east of Eagle Crater, A2 - on the easter side of A1, B – central part of the Rover traverse, C – ca. 8 kilometers south from the end of the traverse. These sectors were selected with visual inspection of the different style of lineament network. The measured geometrical and topological parameters suggest different processes responsible for the formation of the analyzed networks, or what is more likeable overprinting of different processes. In particular, the A1 network shows radial features, which can be related to impact processes. The radial system overprinting is also visible in A2 and B systems; however, these two also show bimodal direction characteristics, related probably to conjugate faulting. The last one, the C system, comprises intensive two sub-perpendicular sets of high interconnectivity, probably of tectonic genesis with no later processes.

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Some remarks about Martian „blueberries" and spherical concretion from Utah

Dr Natalia Zalewska
Centrum Badań Kosmicznych Polskiej Akademii Nauk

[POSTER]

Some terrestrial concretions may be analogs of Martian concretions „blueberries". They were discovered on Mars in the Meridiani Planum by the Opportunity rover. They could have arisen in a similar sedimentation environment as some terrestrial concretions. Therefore, it is important to determine which Earth concretions are analogs of Martian concretions and under what conditions they were formed. For our research, as an analogs we chose: 1) Utah concretions from the Dakota Formation, 2) Utah Navajo Formation concretions, 3) Romanian „Trovants"- concretions. So far, we have used for research: i) modeling spectra from MiniTES using of data from Opportunity's Moessbauer spectrometer for Martian concretions, ii) measurement of near (NIR) and mid-infrared (MIR) spectra and EDS X-Ray Spectroscopy for terrestrial concretions. Our research can determine conditions on Mars during the formation of Martian concretions and would be an evidence for the presence of liquid water in the history of Mars.

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Modeling of selected Martian geomorphological structures in the laboratory

Prof. Leszek Czechowski
Centrum Badań Kosmicznych Polskiej Akademii Nauk
University of Warsaw

[POSTER]

An important turning point in the history of Mars was the decrease in the pressure of the Martian atmosphere to a level when liquid water became unstable on the planet's surface. Water in aquifers boiled. The interaction of steam with the sand layer resulted in the formation of sand volcanoes, landslides and other geomorphological forms. As part of the research, a number of experiments were carried out on the interaction of sand, dust and gravel layers with gas streams. The results indicated several different physical processes (e.g., fluidization) and the formation of various structures, including sand volcanoes. The results of the research were compared with the observations on Mars and cases corresponding to some of the effects found in the laboratory were indicated.

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