

**Резюмета на някои от публикациите,
представени за рецензиране за участие в конкурса за академичната
длъжност „професор”**

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I. Публикации в научни списания с фактор на влияние (impact factor)

1. Mohamed Semeida, Besheir Marzouk, Penka Stoeva, Alexey Stoev, 2015, **Empirical Investigation of Solar Photosphere and Faculae In Ca II IR Triplet Lines Using Non-Local Thermodynamic Equilibrium Method**, Comptes rendus de l'Acad'emie Bulgare des Sciences, Vol 68, No10, pp.1287-1294 (impact factor: 0.251).

The observed emergent intensities at different displacements from the centres of infrared Ca II triplet line (λ 8498.024 Å, λ 8542.091 Å and λ 8662.141 Å) are used to determine the depth-variations of the lines and local continuum source functions in solar photosphere and faculae. Analytical studies of data used are carried out without using local thermodynamic equilibrium (LTE) assumption, and without applying pre-assigned models of the solar photosphere and faculae. The determined distributions of electronic and excitation temperatures at effective depths of formations of photospheric and facular Ca II infrared triplet lines are nearly in agreement with the published values.

2. Mohamed Semeida, Beshir Marzouk, Penka Stoeva and Alexey Stoev, 2016, **Physical Models for CaII IR Triplet lines in Solar Photosphere and Faculae in Non-Local Thermodynamic Equilibrium**, Comptes rendus de l'Acad'emie Bulgare des Sciences, Tome 69, No 8, 2016, pp 1063-1071 (impact factor: 0.251).

Real solar atmosphere is not in local thermodynamic equilibrium (LTE) since its effective infrared, ultraviolet, and visible brightness temperatures are different. Scattering is another non-LTE effect. That is why photospheric and facular physical models have been derived by calculations in non-local thermodynamic equilibrium. They are determined in solar photosphere and faculae by using the observed emergent intensities at different frequencies of Ca II infrared triplet lines (λ 8498.024 Å, λ 8542.091 Å and λ 8662.141 Å).

The physical parameters of the determined models (depth variations of excitation and electronic temperatures, gas and electronic pressures) have been deduced and compared with those given by other published models. The differences between facular and photospheric temperature have been calculated. The obtained results are in good agreement with other models for parameters of Ca II IR triplet lines in solar photosphere and faculae and contribute to the improvement of non-local thermodynamic equilibrium methods and the development of their structure.

3. Abseim A. A., M.A. Semeida, M. Y. Amin, S. M. Youssef, P. Stoeva, A. Stoev, 2017, **Modified cloud method validation for determine the physical parameters of a moderate flare**, Comptes rendus de l'Acad'emie Bulgare des Sciences, Tome 70, No 6, 2017, pp 839 - 848 (impact factor: 0.251).

The studied moderate solar flare on June 26, 1999 was observed in H α line using the multichannel flare spectrograph (MFS) at the Astronomical Institute in Ondřejov, Czech Republic. To fit the H α line profiles, we use a new technique, proposed by Liu and Ding [1]. It is different from the classical cloud model and avoids using the background profile. The five parameters of the flare chromosphere, namely: 1) the source function, 2) the optical thickness at line center, 3) the Doppler shift, 4) the Doppler width and 5) the downward flow velocity for the H α line profiles, are obtained. The theoretical asymmetry profiles derived by the

modified cloud model are in good agreement with the observed ones. The new results are useful for a better understanding of the solar flare dynamics.

4. Stoeva P., A. Stoev, 2018, **Cosmic ray and solar activity influences on long-term variations of cave climate systems**, Comptes rendus de l'Acad'emie Bulgare des Sciences, Tome 71, No 8, 2018, pp (in press, incoming number № 257), (impact factor: 0.251).

During the analysis of solar activity impact on climate, the emphasis is placed on temperature changes. Earth's atmosphere is a dynamical system with a complex movement in space and time. In the last quarter century it has become especially interesting to study the dynamic baric and temperature fields of the lower atmosphere and their impact on the microclimate of caves in Karst, which preserve long term environmental changes.

In this work we investigate the relationship between annual changes in temperature and pressure of the ground atmospheric layer in the region of caves Snezhanka (Pazardjik) and Uhlovitsa (Smolyan), Bulgaria in the period 2005-2017. We show that thermal and mass exchange of the caves' air with the environment has significant temporal variations. On annual basis the thermo-dynamical parameters of the observed caves behaves as a barotropic fluid in which the air density depend only on atmospheric pressure. As a result, the temporal evolution of ground atmospheric pressure and temperature change synchronously with time. The observed 11-year signal could be attributed to the heliospheric modulation of galactic cosmic ray (GCR) intensity, which modulates the ozone and humidity near the tropopause and correspondingly the strength of the atmospheric greenhouse effect. Our study helps to clarify the influence of helio-geophysical factors on the state of the lower atmosphere.

II. Публикации в научни списания в чужбина с рейтинг (SCImago Journal Rank, SJR)

5. Mikhalev A.V., S.V. Podlesnyi, P.V. Stoeva, 2015, **Optical Parameters of Night Sky over Eastern Siberia after the Chelyabinsk Meteor Event. I. Night_Sky Brightness**, Atmospheric and Oceanic Optics, SJR=0.39, ISSN 1024_8560, 2015, Vol. 28, No. 2, pp. 180–184.

Observation results of the night-sky brightness in Eastern Siberia after the Chelyabinsk meteor on February 15, 2013, are presented. During the first nights after the Chelyabinsk meteor landing (February 15/16 and 16/17), diurnal variations in the night-sky brightness showed both an increase and decrease in the nighttime average values of night-sky brightness relative to the preceding (background) nights. An ncrease in the night-sky brightness was observed in late February–early March. No increase in the night-sky brightness was observed in previous years; it is a typical for seasonal variations in the intensity of the continuous night airglow spectrum.

6. Stoeva Penka, Alexey Stoev and Mina Spasova, 2015, **Late Chalcolithic solar-chthonic rock-cut structures for time measuring in the Eastern Rhodopes, Bulgaria**, in Mediterranean Archaeology and Archaeometry , special issue dedicated to the proceedings of SEAC 2015 conference “Astronomy in past and present cultures” Rome, 9 - 13 November 2015, Mediterranean Archaeology and Archaeometry, SJR=0.872, H=19, Vol. 16, No 4,(2016), pp. 401-406, 10.5281/zenodo.220963.

Our paper is focused on Late Chalcolithic solar-chthonic rock-cut structures for time measuring. Here we present two objects from the Eastern Rhodopes, Bulgaria – two additionally processed natural caves, which can be used for determining of the winter solstice – the beginning of one calendar cycle.

Tangarduk Kaya cave sanctuary is situated near the village of Ilinitza, Kardgali district. The different parts of the cave are formed after natural processes of Karst formation and human activity. At the level of the cave gallery floor the entrance aperture is widened and its vertical section is in a special form if they see from the inside outwards. The end of the gallery is obviously formed as altar. Archaeoastronomical investigations show that Tangarduk

Kaya cave sanctuary could be connected with the cult of the Great Mother-Goddess. In the period between 3000 - 2000 B.C. the projection of the entrance aperture during the winter solstice reached 0.4 m from the base of the altar. Besides, this cave sanctuary could be used for determining of the year's duration and its beginning, with enough accuracy.

The other rock-cut object Parmakla Kaya cave sanctuary near the village of Nochevo, Asenovgrad Municipality is in the same category. In the bedrock there is a natural cave, which is additionally processed. Orientation of the main axis of the cave is also in the meridian. Solar projection of the entrance on the day of the winter solstice is with a maximum length along the central axis. This also allows determining the duration of the solar tropical year.

On the vertical part of the rock massif, whose front is south oriented about 40 trapezoidal niches are carved. They are divided into two groups around the entrance of the cave. Probably, they are integrally related to the monument and their orientation allows observation of different shade effects during the movement of the sun on the celestial sphere.

7. Stoev Alexey, Penka Maglova, 2015, Research project "**Astronomical orientations and geophysical anomalies of trapezoidal niches in the Eastern Rhodopes, Bulgaria: in search of an international partnership**", in *Mediterranean Archaeology and Archaeometry*, special issue dedicated to the proceedings of SEAC 2015 conference "Astronomy in past and present cultures" Rome, 9 - 13 November 2015, *Mediterranean Archaeology and Archaeometry*, SJR=0.872, H=19, Vol. 16, No 4,(2016), pp. 407-412, 10.5281/zenodo.220964.

Rock-cut monuments culture covers the Balkan Peninsula, Asia Minor and the European Mediterranean. It includes numerous rock sanctuaries in additionally processed rock massifs. Trapezoidal rock niches are especially popular. They are always cut at a big height, on the vertical walls of visible from afar separate rocks and massifs, predominantly on the sunlit side. Most frequently, niches are trapezoidal, with about 1 meter in height and 40 – 50 cm in depth. Usually, they are in groups of 3 or 4, up to above 100. Up to now, 5000 separate niches are localized. We can differentiate them mainly on their form:

- circle (elliptic, oval);
- rectangular;
- trapezoidal.

Only research of trapezoidal rock niches in the Eastern Rhodopes is suggested in this project. Their specific situation connects them with the ancient cults – worship the Mountain, the Rock, as well as the Sun. It is not clear what kind of tools were used for niches production, and when they are made. Artifacts show that niches were used mainly in the period of 2500 – 1500 BC. Later, they were reused.

An interdisciplinary approach is needed to apply for the full investigation of rock-cut trapezoidal niches. We should apply methods of archaeoastronomy, cultural science, ethnography, and other sciences. Taking into account the widespread culture of trapezoidal niches in Mediterranean civilizations, authors suggest collecting team of specialists for localization, documentation and dating of the trapezoidal rock niches. This research could be conducted through realization of a large-scale scientific European project lasting 3-5 years.

8. Stoev Alexey, Penka Maglova, Vassil Markov and Mina Spasova, 2015, **Prehistoric rock sanctuary with arch near the village of Kovachevitsa, Bulgaria: spatial orientation and solar projections**, in *Mediterranean Archaeology and Archaeometry*, special issue dedicated to the proceedings of SEAC 2015 conference "Astronomy in past and present cultures" Rome, 9 - 13 November 2015, *Mediterranean Archaeology and Archaeometry*, SJR=0.872, H=19, Vol. 16, No 4,(2016), pp. 413-419, 10.5281/zenodo.220965.

Study of spatial - temporal organization of the sanctuary interior of rock – cut monument with rock arch is presented in this work. The sanctuary is located in the Western Rhodopes, village of Kovachevitsa, Garmen Municipality and it is archaeologically dated back to the Eneolithic. The monument is about 20 meters long and it is part of a large rock ridge. The

topographical, landscape and microrelief features of this monument are described and the excellent view of the ancient observer to the sky and local horizon is noted. An analysis is made of the structural elements of the sanctuary and possible observational purposes. Astronomical azimuths of the base lines connecting the arch opening and the other elements of the sanctuary are determined. It has been found that sunrise during the summer solstice can be observed from the observational platform through the arch opening. Chronological boundaries of existence of the rock-cut monument are determined. They refer to the era of the late Eneolithic - III - II millennium BC.

III. Публикации в чужбина в научни списания, в сборници и поредици без импакт фактор и рейтинг, сборници и трудове от научни конгреси, симпозиуми, конференции и др

9. Muglova Penka, Alexey Stoev, Mina Stoeva, Peter Stefanov, **Extreme rises and meridional Sun culminations in the cult practice of the Thracian civilization**, Proceedings of the 10th International Congress of Thracology, Komotini – Alexandroupolis, Greece, 18 – 23 October 2005, Athens, 2007, pp 407-415.

An analysis of structural, target and referent points' elements depending on their autochthonous composition has been made after the classification of rock-cut monuments and cave sanctuaries and their grouping in different types of complexes (Stoev and Varbanova 1996, 93-100). As a result, it became possible to ascertain some characteristic peculiarities and specify past observations. Up to now, rock-cut monuments and cave sanctuaries were generally dated back to the 2nd- 1st millennium

BC and their blooming was connected with the 7th-1st c. BC. Some data point out that rocky-cave sanctuaries came into being as early as the end of the 4th millennium BC (Raduncheva 1990, 1996), and remained in function during the Roman expansion in the 2nd-3rd c. (Fol 1990). In absolute dates, the prehistoric epochs do not coincide for different regions of Euro-Asia and Africa, and a general rule is that, in a more eastern direction, rock-cut monuments date from earlier epochs (Fol 2000, 7-10).

Consequently, the rock-cut monuments and cave sanctuaries are among the most conservative manifestations of ancient ethnic communities.

10. Stoev Alexey, Georgi Kitov, Penka Muglova, **Spatial orientation and geometry of temples and tombs in the tumuli of the Valley of the Thracian Rulers**, Proceedings of the 10th International Congress of Thracology, Komotini – Alexandroupolis, Greece, 18 – 23 October 2005, Athens, 2007, pp 557-560.

Basic morphometric characteristics of temples and tombs in tumuli situated on the territory of the Valley of the Thracian rulers have been mapped and documented during a complex archaeoastronomical expedition of the Group of archaeoastronomical research and expeditions (APEX) at Yuri Gagarin Public Astronomical Observatory, Stara Zagora, Bulgaria. Geodetic plans of 6 sites have been made with an accuracy of angular measurements $\pm 3''$ and $\pm 0,01$ m for the linear measurements. Astronomical azimuths of the main axes of the temples have been measured. Their coincidence with rises and culminations of the Sun at the time of construction and functioning of these buildings have been examined.

11. Georgieva K., Stoeva P., Stoev A., **International Heliophysical Year – Education and Public Outreach activities in Bulgaria**, In Putting the “I” in IHY, The United Nations Report for the International Heliophysical Year 2007, Studies in Space Policy, vol.3, B.J. Thompson, N.Gopalswami, J.M.Davila, H.J.Haubold Editors, 2009 Springer – Verlag/Wien, Library of Congress Control Number: 2009931219, ISSN 1868-5307, ISBN 978-3-211-99179-4, SpringerWienNewYork, pp191-198, 2009.

Here, in Bulgaria, joint initiatives of the Solar–Terrestrial Influences Laboratory of the Bulgarian Academy of Sciences, and the Yuri Gagarin Public Astronomical Observatory and

Planetarium, Stara Zagora are aimed to increasing the visibility and accessibility of existing IYU outreach programs, to developing existing programs and activities to broaden their scope and impact.

We have planned and coordinated activities – part of global outreach events. Many of them take place on a local scale according to the educational goals and resources. Basic IYU initiatives were presented at the May 2007 National Conference of Physics in Pleven to the teachers from all over Bulgaria and at the April 2007 National Conference on Astronomy in Varna to the teaching staff of all the Astronomical Observatories and Planetaria in Bulgaria.

12. Медведева И.В. Михалев А.В., Стоева П., Черниговская М.А. "Сезонные вариации атмосферной эмиссии атомарного кислорода 557.7 нм по данным наблюдений в Иркутске и Старой Загоре". // Оптика атмосферы и океана. Физика атмосферы. Материалы XVI Международного симпозиума (12-15 октября 2009 г.). – Томск: Изд-во Института оптики атмосферы СО РАН, С.569-570, 2009.

В работе представлены результаты исследования сезонных вариаций атмосферной эмиссии атомарного кислорода 557.7 нм по данным наблюдений в Иркутске (52N, 103E) и Старой Загоре (42.4N 25.7E). Проведенное сравнение показало качественное совпадение сезонного хода интенсивности эмиссии 557.7 нм для двух регионов наблюдения. Выявлены количественные отличия, заключающиеся в повышенных значениях интенсивности эмиссии 557.7 нм в регионе Восточной Сибири в зимние месяцы по сравнению с данными наблюдений в Старой Загоре и полученными на других среднеширотных станциях. Также проведено исследование сезонного хода эмиссии 557.7 нм по данным наблюдений в Иркутске от уровня солнечной активности.

13. Stoeva P. V., Stoev A. D., Kuzin S. V, White light corona at different phases of the solar cycle, Sun and Geosphere, 6(1), 2011, pp 33-35, ISSN 1819-0839.

White light corona observations during 3 total solar eclipses (1999, 2006 and 2009) at different phases of the solar cycle, and comparative analysis of the results are presented in this work.

Photos are made with objectives with different focus and exposure. Structures of the coronas are determined from composite images. Solar corona flattening is determined and its dependence from the solar cycle phase is investigated.

The connection of coronal structures with the long streamers is also studied.

14. Stoeva P., A. Stoev, S. Kuzin, Solar Corona In White Light During Five Total Solar Eclipses, Sun and Geosphere, The International Journal of Research and Applications, Vol.7 - No.1 – 2012, pp.81-84 , Editor-in-Chief: Atila Ozguc, Guest Editors: Katya Georgieva, Vladimir Obridko, Georgeta Maris, Tamara Breus, Rositza Koleva, Yurdanur Tulunay, ISSN: 1819-0839.

Solar corona in white light, at different stages of the solar activity cycle has been analyzed during the 1990, 1999, 2006, 2008 and 2009 total solar eclipses (TSEs).

Deviation of the coronal streamers from radial direction during minimum solar activity has been investigated. We have found that inclination of the streamers towards the equator is larger for the eclipses in deep solar minimum (2008 and 2009) in comparison with the 2006 TSE, which is also in minimum.

Values of the photometric flattening index at minimum of the solar cycle can be used for predictions of the amplitude of the cycle. We have made two estimations for the amplitude of the solar cycle 24 in terms of the smoothed monthly sunspot numbers using indices for TSEs before and after minimum - in 2008 and in 2009. The obtained values are 146 ± 65 and $99,7 \pm 65$, accordingly.

15. Stoev A., Stoeva P., Kuzin S., Total Solar Eclipses and Atmospheric Boundary Layer Response, Sun and Geosphere, The International Journal of Research and Applications, Vol.7 - No.1 – 2012, pp.103-107 , Editor-in-Chief: Atila Ozguc, Guest

Editors: Katya Georgieva, Vladimir Obridko, Georgeta Maris, Tamara Breus, Rositza Koleva, Yurdanur Tulunay, ISSN: 1819-0839.

The effect of three total solar eclipses on meteorological parameters is discussed in the paper. Measurements were conducted at the village of Ravnets, General Toshevo municipality, Bulgaria, 1999, in Manavgat, near Antalya, Turkey, 2006 and in TianHuangPing, China, 2009.

The observed decrease of the sky illumination (incoming solar radiation) during the eclipses was proportional to the percentage of solar coverage. The after eclipse sky illumination level is due to the effect of the natural change of the solar elevation angle. For the 1999 TSE it did not regain its pre eclipse value, it has exactly the same value for the 2006 TSE, and, It is three times larger than the pre eclipse value for the 2009 TSE. This fact can be easily explained by the Local Time of the maximum of the eclipses: LT 13:12, LT 12:58, and LT 09:34, respectively. Measurements showed significant changes in the surface air temperature. The minimum of the air temperature during the 2009 TSE ($T_{min}=4.5^{\circ}\text{C}$) was measured 6 min after the end of the total phase. This minimal temperature drop and larger time lag can be explained with the huge artificial lake near the place of observation, which minimizes the temperature response due to its larger heat capacity.

During the 1999 TSE, minimal temperature ($T_{min}=6.4^{\circ}\text{C}$) is measured 7 min 30 s after the total phase, and for the 2006 TSE ($T_{min}=5^{\circ}\text{C}$) - 5 min. It is in accordance with the fact that the temperature minima at residential/commercial stations occurred in general, before the minima at stations in agricultural terrains. In 2006 we were at the yard of the hotel, and in 1999 in the countryside.

The wind velocity drops during the total phase as a result of the cooling and stabilization of the atmospheric boundary layer. The wind direction during the total phase changes and the wind begins to blow in the same direction as the direction of motion of the lunar shadow on the earth.

Cirrus and cirrostratus clouds were observed during the 2006 total solar eclipse. Cloud structures in the form of narrow concentric arcs, equally detached from one another were observed for 20 minutes, after the beginning of the maximum phase of the 1999 TSE.

16. Михалев А.В., Леонович Л.А., Костылева Н.В., Леонович В.А., Стоева П., **Отклик среднеширотного излучения верхней атмосферы на начальную фазу магнитных бурь**, XVIII Международный симпозиум «Оптика атмосферы и океана. Физика атмосферы». 2-6 июля 2012 г. Иркутск. Сборник докладов. Издательство ИОА СО РАН. 2012. D237- D240.

Исследуется отклик среднеширотных атмосферных эмиссий атомарного кислорода 557.7 и 630 нм на начальную фазу магнитных бурь. Выделены события, для которых достаточно надежно выделяются возмущения в эмиссии 630 нм в начальную фазу магнитных бурь. Отмечается корреляция с вариациями D_{st} -индекса и геомагнитного поля. Обсуждаются возможные источники возмущений атмосферных эмиссий.

17. Alexey Stoev and Penka Maglova, **Astronomy in the Bulgarian Neolithic in Handbook of Archaeoastronomy and Ethnoastronomy**, part VIII, Springer Reference, , Springer New York, C.L.N. Ruggles (Ed.), 2015, XXXVI, 2297 p. 969 illus., 372 illus. in color. In 3 volumes, not available separately, Hardcover ISBN: 978-1-4614-6140-1, Online ISBN: 978-1-4614-6141-8, 07 July 2014, DOI 10.1007/978-1-4614-6141-8_137, http://link.springer.com/referenceworkentry/10.1007/978-1-4614-6141-8_137, 2014, pp 1377-1384.

Bulgaria is famous with the richness of its Neolithic culture, with the large variety of artistic representations with deep semantic meaning. Here, we consider several types of monuments, in which evidences for the astronomical culture of the Neolithic / Eneolithic people are found. The emergence and development of the Neolithic and Eneolithic societies in Bulgarian lands have been considered. The material and spiritual culture in chronological boundaries of its existence is described. Specific monuments are discussed and it is shown

how astronomy is woven into the everyday and spiritual life, what are the concepts of space and time: Karanovo - the largest and one of the oldest tells in Europe, Topchika cave with the earliest rock pictures, Magura cave - one of the largest and beautiful caves in Bulgaria, famous with its unique paintings, Bailovo cave complex with the Lunar images and calendar frieze composed of monochrome paintings, and the Tangarduk kaya cave sanctuary as an example of observations of extreme sun meridian culminations.

18. Penka Maglova and Alexey Stoev, **Thracian sanctuaries**, in **Handbook of Archaeoastronomy and Ethnoastronomy**, part VIII, Springer Reference, Springer New York, C.L.N. Ruggles (Ed.), 2015, XXXVI, 2297 p. 969 illus., 372 illus. in color. In 3 volumes, not available separately, Hardcover ISBN: 978-1-4614-6140-1, Online ISBN: 978-1-4614-6141-8, 07 July 2014, DOI 10.1007/978-1-4614-6141-8_135, http://link.springer.com/referenceworkentry/10.1007%2F978-1-4614-6141-8_135, 2014, pp 1385-1394.

Great part of the Ancient **Thrace** is on the territory of modern Bulgaria. **Sanctuaries** are a characteristic elements of the Thracian cultural tradition - rock-cut monuments in **Mountain Thrace** and **temples** and **tombs** in **tumuli** in lowlands.

Rock-cut sanctuaries are cult centres situated high above the settlements and near water springs, in position convenient for observation of the horizon and celestial phenomena. Archaeoastronomical research show that they are ancient solar observatories devoted to the cults of the Sun and the **Great Mother-Goddess** (Cybele).

An excellent example for temples and tombs in tumuli is the Valley of Kazanluk, Bulgaria (situated in the lowland between the mountains of Sredna gora and the Balkans), named "The valley of the Thracian rulers". It is naturally differentiated territory with specific cultural characteristics and heritage. There is about 1500 mounds and the excavated ones reveal typological diversity and richness of the Thracian temple and grave architecture during the whole I millenium BC and the Roman epoch.

Archaeoastronomical investigations allow us to suppose that the main purpose of these systems is ritual determining of the longest and the shortest day of the year when, at the days of solstice, sun beams illuminate sacred spots of the temples connected with specific cult practices of the society of that epoch.

19. Mikhalev A.V., S.V. Podlesny, P.V. Stoeva, 2016, **Night airglow in RGB mode**, **Solar-Terrestrial Physics**, Vol. 2. Iss. 3, pp. 106–114, DOI: 10.12737/22289. © INFRA-M Academic Publishing House, Original Russian version published in **Solnechno-Zemnya Fizika**, 2016, vol. 2, iss. 3, pp. 74–80, DOI: 10.12737/19040.

To study dynamics of the upper atmosphere, we consider results of the night sky photometry, using a color CCD camera and taking into account the night airglow and features of its spectral composition. We use night airglow observations for 2010–2015, which have been obtained at the ISTP SB RAS Geophysical Observatory (52° N, 103° E) by the camera with KODAK KAI-11002 CCD sensor. We estimate average brightness of the night sky in R, G, B channels of the color camera for eastern Siberia with typical values ranging from ~0.008 to 0.01 erg·cm⁻²·s⁻¹. Besides, we determine seasonal variations in the night sky luminosities in R, G, B channels of the color camera. In these channels, luminosities decrease in spring, increase in autumn, and have a pronounced summer maximum, which can be explained by scattered light and is associated with the location of the Geophysical Observatory. We consider geophysical phenomena with their optical effects in R, G, B channels of the color camera.

For some geophysical phenomena (geomagnetic storms, sudden stratospheric warmings), we demonstrate the possibility of quantitative relationship between enhanced signals in R and G channels and increases in intensities of discrete 557.7 and 630 nm emissions, which are predominant in the airglow spectrum.

20. Beshir Marzouk, Penka Stoeva and Alexey Stoev, 2016, **White Light Coronal Structures and Flattening During Six Total Solar Eclipses**, IAGA international

Symposium-IV "Influence of short and long term solar variability on climate", Hurghada, Egypt, 20 -24 March 2016, Elsevier Press, NRIAG Journal of Astronomy and Geophysics, SJR Directory of Open Access Journals (DOAJ), 2016, 5, pp 297–300, <http://dx.doi.org/10.1016/j.nrjag.2016.08.003>.

Solar corona is very important part of the solar atmosphere, which is not available every time and it is very difficult to observe it. From solar corona we can get more information about outer sun layers. Large-scale structure of the solar corona can be studied during total solar eclipses.

The structure, shape and brightness of the solar corona significantly change from eclipse to eclipse. They depend on activity of the sun. At maximum solar activity, the corona is very bright and uniform around the solar limb. There are a lot of bright coronal streamers and other active regions on it. During minimum of solar activity the solar corona stretches at the equator and become elliptical.

Flattening index is the first quantitative parameter introduced for analyses of the global structure of the solar corona. It varies with respect to the phase of the solar activity and sunspot number. In this paper we study the solar corona during the 1990, 1999, 2006, 2008, 2009 and 2012 total solar eclipses. We obtain flattening coefficients for all the six eclipses by using a new computer program.

Our results are in a good agreement with published results.

21. Stoeva Penka, 2016, Ancient Solar Observations from Rock Sanctuaries at East Rhodopes, Bulgaria, Proceedings of the International conference under the patronage of UNESCO "Astronomy and world heritage: across time and continents", 19-23 August, 2009, Kazan, Russia, pp135-142.

Two very impressive sanctuaries from the East Rhodopes are analyzed and shown as examples of observations of solar extreme rises and meridional culminations – Tatul and Tangarduk Kaya.

The Tatul rock sanctuary is situated at an elevation near the village of Tatul, Momchilgrad Municipality. The highest part of the rock is cut in the form of a truncated pyramid and a sarcophagus at its top. The axis of the sarcophagus is oriented towards the sunrise during a winter solstice. There is an artificial, East-West oriented trench with about 2.5m length and 0.8m width at the ends, at the south part of the main rock . It is narrowed in the middle and resembles the letter "X" if we watch in the horizontal plane. In the middle of the "X" one can see a vertical aperture with 8-10cm width and 50cm depth. The line of sight through this aperture is directed to the Sunrise during vernal or autumnal equinox. There are also different thrones, which could be considered as places for observation of natural or artificial marks on the horizon.

Large amount of solar symbols – circles of different size hewn out in the rock – have been discovered in the region of the Tatul sanctuary.

We can suppose that observation of the Sun during vernal and autumnal equinox had been used for determining the active agricultural period. Orientation of the sarcophagus's main axis towards winter solstice is probably connected with a cult festival.

The basic morphological elements of Tangarduk Kaya cave sanctuary, placed near the village of Ilinita, Kardjali district are mapped and documented during a complex archaeoastronomical expedition. A geodetic plan is made with an angle accuracy of 6 arc seconds and linear precision of 0,01 m. The different parts of the cave are formed after natural processes of Karst formation and human activity. They are estimated by geomorphological analysis. The astronomical azimuth of the cave's main axis is $A=15^{\circ}08'12''$ and the entrance projection coincides with it at noon. At the level of the cave gallery floor the entrance aperture is widened and its vertical section is in the form of phallus if they see from the inside outwards. The end of the gallery is obviously altar formed as vulva. There are two cupolased zones in the gallery as well where amplifying of the sound and long acoustic reverberation in

the lower frequencies of the sound spectrum are registered. The archaeoastronomical investigations show that Tangarduk Kaya cave sanctuary could be connected with the cult of the Great Goddess-mother. In the period between 1000 B.C. and 2000 B.C. the projection of the entrance aperture during the winter solstice reached 0.4 m from the base of the altar. Besides, this cave sanctuary could be used for determining of the year's duration and its beginning, with enough accuracy.

22. Alexey Stoev, Penka Maglova, and Mina Spasova, 2017, **Evolution of astronomical facilities and practices in Ancient Thrace**, INSAP X – Oxford XI - SEAC XXV conference, ROAD TO THE STARS, 18th – 22nd September 2017, Santiago de Compostela, Spain, ABSTRACT BOOKLET, Edited by A. César González García, Patricia Martin-Rodilla and Juan A. Belmonte, pp 191-193, ISBN: 978-84-697-5608-9.

Evolution of megalithic and rock-cut monuments used for astronomical observations and practices in ancient Thrace are presented in this work. Classification is made after independent archaeoastronomical research the rock-cut monuments and cave sanctuaries.

The discovery and the accumulation of "in situ" material allow to identify the signs of the formation of a number of their parameters - territorial, chronological, functional. One of the promising areas of research, for example, is to distinguish different rock shrines and megalithic complexes associated with long term astronomical observations and astronomical practices. Another area is the specification of the affiliation of individual objects to synchronously existed settlements and tribal communities. This way, reasons for their appearance, function and place in everyday life of citizens and society in Ancient Thrace can be justified. People of the then society obviously have created and continuously used the powerful solar-cthonic cult united the cult of the Sun and this to Heaven and Stone.

Shapes and spatial relations of the megalithic and rock-cut monuments used for astronomical observations depend on the topography of the region, archaeological structures found and their basic functions and context of use.

The concept of "dynamic structure of the rock-cut monument" is suggested in the report which means that it is characterized not only with space but also with time parameters. Time parameters are cyclicity and duration of existence of rock-cut monuments connected with various cults and cult practices.

Typology of the rock-cut monuments according to their locality, landscape of the environment, functional astronomical elements, and accuracy shows the evolution of astronomical facilities and practices.

23. Penka Stoeva, Alexey Stoev, Sergey Kusin, Beshir Marzouk, Andrey Pertsov, Mohamed Semeida, 2018, **Structure and dynamics of the solar corona observed during different phases of the solar cycle**, 41st Annual Seminar "Physics of Auroral Phenomena", March 12-16, 2018, Apatity, Russia, Proceedings of the 41st Annual Seminar, <http://pgia.ru/seminar>, (in press).

Study of the solar corona is very important from point of view of solar physics and solar-terrestrial relations. The solar corona is composed of both closed magnetic loops emerging from the photosphere and "open" magnetic field regions that form the heliosphere.

White light corona can be observed only during total solar eclipses (TSE) because its intensity is much lower than the brightness of the sky. Observations of the total solar eclipses (TSE) in 1990, 1999, 2006, 2008, 2009, 2012 and 2017, which are at different stages of the solar activity cycle, were conducted. Our expeditions and experiments were part of the Bulgarian National scientific program for observation of the specific total solar eclipse in collaboration with scientists from Russia, France and Egypt. The sites were chosen to be in the line of totality. We have made an analysis of the white light coronal structures and shape. Polar plumes, dome-shaped and "helmet" type structures are the basic coronal formations. They are evident from composited images of different number of negatives taken with a variety of exposures. Our composited images are compared with the images of the C2

coronagraph of Naval Research Laboratory's LASCO instrument on ESA's Solar and Heliospheric Observatory (SoHO).

The structure, shape and brightness of the solar corona significantly depend on the activity of the sun. The corona is very bright and uniform at solar activity maximum. We can observe a lot of bright coronal streamers and other active regions on it. During minimum of the solar activity the corona becomes asymmetric - it stretches at the equator. The Ludendorff flattening index (ellipticity) is the first quantitative parameter introduced for analysis of the global structure of the solar corona. It is anticorrelated with solar activity and varies between minimum and maximum. Analysis of the ellipticity coefficient and phase of the solar cycle show that white light corona during the 2006, 2008, 2009 and 2017 TSE (solar minimum) is asymmetric in contrast to solar corona observed during the 1990, 1999 and 2012 solar eclipses (solar maximum). Moreover, value of the photometric flattening index at a cycle minimum can be used to forecast the amplitude of the cycle.

These results can contribute to development of contemporary notion of the physical characteristics, shape and structure of the solar corona and its evolution with the solar activity cycle.

24. Penka Stoeva, Alexey Stoev, 2018, Influence of the solar activity on cave air temperature regimes, 41st Annual Seminar "Physics of Auroral Phenomena", March 12-16, 2018, Apatity, Russia, Proceedings of the 41st Annual Seminar, <http://pgia.ru/seminar>, (in press).

Caves and their evolution are influenced by solar activity as all the natural processes. The study of this influence needs constant monitoring of the air temperature and physical parameters of the cave – rock temperature, condense processes, heat exchange etc.

We discuss cave air temperature response to climate and solar and geomagnetic activity for four show caves in Bulgaria (latitude $\varphi=42.50^\circ$, longitude $\lambda=25.30^\circ$) for a period of 46 years (1968 – 2013). Everyday noon measurements in Ledenika, Saeva dupka, Snezhanka and Uhlovitsa cave have been used.

Cave temperatures in the zone of constant temperatures (ZCT) are compared with surface temperatures recorded at meteorological stations situated near about the caves – in the towns of Vratsa, Lovech, Peshtera and Smolyan, respectively.

The Hansen cave, Middle cave and Timpanogos cave from the Timpanogos Cave National Monument, Utah, USA have also been examined for comparison (latitude $\varphi=40.27^\circ$, longitude $\lambda=111.43^\circ$).

It has been found that the correlation between cave air temperature time series and sunspot number is better than that between the cave air temperature and A_{pmax} indices; that t°_{ZCT} is rather connected with the first peak in geomagnetic activity, which is associated with transient solar activity (CMEs) than with the second one, which is higher and connected with the recurrent high speed streams from coronal holes.

Decreasing trends in the air temperatures of all examined show caves have been identified, except for the Ledenika cave, which is ice cave. The well known mechanism of cooling is clearly expressed – the dry surface air lowers the temperature of the cave air and the drier air evaporates water from the cave environment, which further cools the cave.

On the contrary, increasing trends in the air temperatures on the surface, measured at the meteorological stations near about the show caves in Bulgaria have been identified. The trend is decreasing for the Timpanogos cave system, USA. It can be concluded that surface temperature trends depend on the climatic zone, in which the cave is situated, and there is no apparent relation between temperatures inside and outside the caves.

Our results can help in studying heat exchange between the surface and subsurface air and its influence on cave ecosystems.

IV. Публикации в научни списания сборници и поредици у нас

25. Stoeva, P., Werner, R., Guineva, V., **Spatial Distribution of the H_2O^+ , CO_2^+ and OH^+ ions in the P/Halley Ionosphere**, Десета национална конференция с международно участие “ Основни проблеми на слънчево-земните въздействия”, в памет на акад. Димитър Мишев, 20 - 21 ноември 2003г., София, сборник с доклади, стр. 18.

The two-dimensional monochromatic composed images (Stoeva et al., 2003 a, b) of the inner coma of P/Halley show the spatial distribution of some species on the sunward side of the comet, at the time of its last apparition in March 1986.

The H_2O^+ , CO_2^+ and OH^+ from the heavy ions group have been investigated in details and the OH and NH radicals are studied for comparison. The integral intensities in kR are plotted versus the projected distance to the nucleus.

All composed images show a jet-like or peaked structure. An increase of the integral intensity at about 11 000 km from the nucleus - specific for the conditions existing in comet Halley at the time of the encounter with Space stations is also observed.

The composed image of H_2O^+ ion glow shows that it forms a peak at the nucleus and two jets – one to the Sun and the other perpendicular to it—as neutrals do. The H_2O^+ ion has the strongest emission in comparison with the other ions – about 2 000 kR.

The monochromatic composed image of the CO_2^+ ion has a peaked structure and a jet-like distribution along the image diagonal. The maximum intensity displacement from the nucleus towards the Sun is well outlined. This may be due to the destruction of CO_2^+ ions by reactions with neutral molecules (mainly H_2O) in the inner coma (Huebner and Giguere, 1980).

The OH^+ ion and NH radical are examined simultaneously in order to distinguish the emissions, which have a very similar spectral structure and are very close to each other. The OH^+ ionosphere of Halley comet is with a peaked structure. The comparison with the NH image shows that the spatial distributions are different and the intensities of NH are higher.

Radial profiles of the H_2O^+ , CO_2^+ and OH^+ ions are very similar. The course change around 5000 km can be explained by transition of the ionopause (contact surface). At distances larger than 10 000 km, in the region dominated by collisions between cometary ions and the Solar wind plasma, a $1/p$ dependence approximately fits the data.

The results of this work can contribute to the understanding of the processes in the inner coma, or for improving the models of the Solar wind – comet interaction in small scale.

26. Stoeva P., Stoev A., Kuzin S., Stoyanov N., Pertsov A., Shopov. Y., **White light and monochromatic corona during the total solar eclipse on March 29, 2006**, Proceedings of the International conference: Fundamental Space Research, Recent development in Geocology Monitoring of the Black Sea Area and their Prospects, Sunny Beach, Bulgaria, September 21-28, 2008, Dachev Ts. (Editor in Chief), Tishchenko Y., Savorski V. (Co-Eds), Sofia, 2008, ISBN 978 954 322 316 9, pp. 242-245, <http://www.stil.bas.bg/FSR/>.

White light and monochromatic solar corona has been investigated using photographic observations conducted during the total solar eclipse on March 29, 2006 in Manavgat, Turkey. Spectroscopic study of the green 530.3 nm line of Fe XIV in the corona has been made with the help of spectrograph designed by specialists from STIL-BAS "Acad. D. Mishev", Stara Zagora Department, Bulgaria, Lebedev Physical Institute, Moscow, Russia and Yuri Gagarin Public Astronomical Observatory, Stara Zagora, Bulgaria.

All the basic coronal structures such as polar streamers, dome-shaped structures and “helmet” type structures, are evident from a composite image of 16 negatives. The axis of symmetry of the “helmet” type streamers is tilted towards the solar equator and the deviations from a radial direction in western hemisphere are greater than that in eastern one ($21^\circ / 8^\circ$).

Solar corona flattening corresponds to an intermediate (before the minimum) type of corona. It is $\varepsilon = 0.098$. The solar cycle phase for the 2006 total solar eclipse is $\Phi = 0.17$.

In contrast to white light solar corona observed during the August 11, 1999 total solar eclipse the 2006 corona is asymmetric.

Red and green lines are well observed in the equatorial areas. Red line is uniformly distributed around the Solar limb but the green one is situated in the region with spots.

27. Mikhalev A.V., Medvedeva I.V., Stoeva P.V., Kostyleva N.V., **Solar activity influence on the atmospheric green and red oxygen lines during the 23rd solar cycle**, Proceedings of the International conference: Fundamental Space Research, Recent development in Geoecology Monitoring of the Black Sea Area and their Prospects, Sunny Beach, Bulgaria, September 21 - 28, 2008, Dachev Tsvetan (Editor in Chief), Tishchenko Y., Savorski V. (Co-Eds), Sofia, 2008, ISBN 978 954 322 316 9, pp. 391-394, <http://www.stil.bas.bg/FSR/>.

Preliminary analysis of experimental data of nightglow observation of the atomic oxygen 557.7 nm (emitting layer height is 85-115 km) and 630 nm (180 - 250 km) lines emissions in the current solar cycle is presented. The experimental data were obtained at ISTP Geophysical observatory near Irkutsk (52° N, 103° E). The 557.7 nm and 630 nm emissions observational data are compared with atmospheric, solar and geophysical parameters. In general, the 630 nm emission intensity changes in a phase with the solar cycle 23, increasing from a period of low solar activity to a period of high solar activity. A difference of the correlation coefficient between the 557.7 nm emission intensity and $F_{10.7}$ solar radio flux in various phases of the 23-d solar cycle was marked. During the increasing and maximum phases of the solar cycle, a negative correlation between the monthly mean 557.7 nm emission intensity and the $F_{10.7}$ flux has been revealed. The correlation becomes positive during the descending phase of the solar cycle.

Changes of the synchronism between 557.7 nm emission behaviour and $F_{10.7}$ flux during the growth and maximum phase of solar cycle is preliminary interpreted as a result of influence of effects from the lower atmospheric layers.

This work was supported by RAS Presidium Program №16 (Part 3) and by the Russian-Bulgarian project "ATMOS".

28. Stoev A., Stoeva P., **Total Solar Eclipses - Derivation of Scientific Data from Amateur Observations**, Proceedings of the International conference: Fundamental Space Research, Recent development in Geoecology Monitoring of the Black Sea Area and their Prospects, Sunny Beach, Bulgaria, September 21-28, 2008, Dachev Ts. (Editor in Chief), Tishchenko Y., Savorski V. (Co-Eds) Proceedings online - <http://www.stil.bas.bg/FSR/>, Sofia, 2008, ISBN 978 954 322 316 9, pp 395-398.

This work presents the educational approach of using total solar eclipse occurrences as a scientific process learning aid. The work reviews the basic scientific aims and experiments included in the observational programs "Total solar eclipse'1999 and 2006" (Stoev et al., 1999 a; Stoeva et al., 2005).

Results from teaching and training the students in the procedures, methods and equipment necessary for the observation of a total solar eclipse (TSE) at the Yuri Gagarin Public Astronomical Observatory (PAO) in Stara Zagora, Bulgaria, as well as the selection process used in determining participation in the different observational teams are discussed.

The final stages reveal the special methodology used to investigate the level of "pretensions", the levels of ambition displayed by the students in achieving each independent goal, and the setting of goals in context with their problem solving capabilities and information gathering abilities in the scientific observation process.

It is also shown that the students benefit from the activities of processing data, observational results and their interpretation, and preparation of summary reports. This enables the students to further develop their creative skills, emotional – volitional personal qualities with an orientation towards scientific analysis, using observations and experiments, to build an effective scientific style of thinking.

Students of the Yuri Gagarin Public Astronomical Observatory, whom are already being nurtured in this manner, should be able to participate with great success in Scientific Research Programmes devoted to the International Heliophysical Year.

29. Стоев А., Стоева М., Мъглова П., Археoaстрономическите паметници в България като предмет на изучаване в школи и кръжоци по астрономия, Сборник доклади от XXXVII Национална конференция по въпросите на обучението по физика „Обучението по физика и астрономия в условията на новата образователна структура на средното училище, Русе, 2-5 април 2009г., Херон Прес ООД, ISBN 978-954-580-261-4, стр. 294-297, 2009.

Археoaстрономията се ражда официално в средата на XX век с публикуването на научните статии на английския астроном Джералд Хоукинс. Те са посветени на астрономическите елементи и съдържание на уникалния археологически паметник Стоунхендж, Англия. Днес, археoaстрономически изследвания се провеждат интензивно в почти всички европейски страни, обединени в SEAC - European Society for Astronomy in Culture (Европейско общество за астрономия в културата), учредена през 1993 г. в България. Това става и в световен мащаб, като специалистите, работещи в областта на археoaстрономията са обединени в международната организация ICHA - Inter-union Commission for History of Astronomy (Междусъюзна комисия по история на астрономията - Комисия №41 (История на астрономията) на Международния астрономически съюз (IAU – International Astronomical Union) и Отдела по история на науката на Международния съюз по история и философия на науката (Division of History of Science of the International Union for History and Philosophy of Science).

Археoaстрономията е дял от науката, който се формира в контактната зона между хуманитарното и естественонаучно човешко знание. Предмет на нейното изследване са паметници от древната безписмена епоха на Човечеството, изучавани с методите на археологията, астрономията и другите фундаментални или приложни науки. Целта на изследванията е да се възстановят астрономическите знания и култура на древните безписмени общества, отчитайки еволюционните фактори в заобикалящата ги природна среда. Получените данни и резултати от археoaстрономическите изследвания показват, че всички главни страни на древните светогледни системи (представата за света, за душата, за жизнения кръговрат и др.), както и природно – стопанските цикли, социалната стратификация, организацията на селищните и ритуални комплекси са свързани тясно с нивото на осмисляне от древния човек на структурата на Вселената и основния смисъл на съществуване на Природата. Археoaстрономическите изследвания са важни и за разбирането на различните страни от историята и културата на древните безписмени общества, тяхната логика на мислене, психология на общуване, манталитет, стимули на развитие, маниери на природна и социална адаптация.

30. Stoeva P., Stoev A., Kuzin S., Stoyanov N., Pertsov A., Observations and experiments during the total solar eclipse on July 22, 2009, China, Fundamental Space Research 2009, pp 132-134, 2009.

Results from the scientific expedition for observation of the July 22, 2009 total solar eclipse are shown in this work. The equipment of the Solar-Terrestrial Influences Institute “acad. D.Mishev” and the Yuri Gagarin Public Astronomical Observatory was displaced near the observing station of the [Shanghai Observatory](#), which belongs to the [Chinese Academy of Sciences](#) and is very close to the central line of the eclipse.

White-light corona was investigated by observations with 250 mm objective and 2000 mm Maksutov - Cassegrain telescope. Intensity of the red coronal line FeX 6374A was also observed with a spectrograph designed and developed by specialists from STIL-BAS "Acad. D. Mishev", Stara Zagora Department, Bulgaria, Lebedev Physical Institute, Moscow, Russia and Yuri Gagarin Public Astronomical Observatory, Stara Zagora, Bulgaria, mounted on the telescope.

Atmospheric response during the eclipse was determined using measurements of the temperature of both the air at three different levels - 10 cm, 50cm and 200cm and the soil, and humidity.

The absolute illuminance of the sky during the eclipse was measured by three photometers - horizontal, in zenith and in the plane of the Sun.

The July 22, 2009 total solar eclipse was the longest one for this century. We succeeded to observe it but the weather conditions were not good. All the time cirrus clouds were on the sky. We obtained good images of the inner solar corona in white light taken with a short exposition and several long exposure images of the outer solar corona taken between the clouds.

31. Stoeva P., Stoev A., Research and education in astronomy and solar-terrestrial relations in Bulgaria, Fundamental Space Research 2009, pp 262-265, 2009.

IHY education and public outreach activities in Bulgaria are presented in this work:

- National initiatives - lectures, public talks and exhibitions, observations, creation and translation of educational materials;
- Participation in the world initiatives Solar Week, Sun-Earth Day, Yuri's Night, World Astronomy day and World Space week.

SID space weather monitor is used for regular observations of the Earth's ionosphere reactions to the intense X-ray and ultraviolet radiation released by the Sun during solar events and by lightning during thunderstorms.

Programmes devoted to the World Astronomy Year – 2009 and the International Space Weather Initiative (2010 – 2012) are also discussed.

32. Stoev A., P. Maglova, M. Spasova, Megalithic culture of the Eneolithic societies: Archaeoastronomical aspects, Proceedings of the First International Symposium "Ancient cultures in South-East Europe and the Eastern Mediterranean. Megalithic monuments and cult practices", October 11-14, 2012, Neofit Rilski University press, Blagoevgrad, 2013, pp 194-206.

A lot of megaliths and sacred territories were discovered in the West Rhodopes during the last decade. Archaeological studies have shown that the Eneolithic Age could be considered as a beginning of their chronological boundaries of existence. They have become famous as monuments keeping one of the oldest technologies in the history of Civilization. Archaeoastronomical study shows presence of alignments with rises and settings of the Sun. The Eneolithic man was a specialist in rock-cutting, with wide knowledge on practical geometry, studying the Sun and Moon motion with interest, piling up astronomical information in a special way. It gives a proof that this megalithic culture is connected with a high level of astronomical knowledge and geometric practice.

Basic problem of the Eneolithic astronomy was the discovery of astronomically significant directions. Today, we discover alignments with Sun rises and settings. Astronomical knowledge in the structure of megaliths and sacred territories shows the importance of numerous rock-cuttings discovered everywhere on their surface. The idea of the "stone sky" known from mythology evokes analogy between "eternal rock" and "everlasting sky".

Space – time organization of the sanctuary interior of the megaliths and sacred territories, from the Eneolithic and the beginning of the Bronze Age, on the territory of the West Rhodopes, have been searched in the work. Landscape and topographic peculiarities of these sacred monuments are described, and their perfect for the ancient observer of the sky view is mentioned. It is looked for geometric centres of the observational lines connecting the extreme points of sunrises and specific structures of the autochthonic rock relief. Problems of the general observational practice in the space of the investigated megaliths and sacred territories, as well as the probable prognostic abilities of the complex of observational vectors, pointed towards specific points from the horizon connected with day and night and annual solar cycle are discussed. Elements of the space organization of the monuments relevant to

solar symbols are shown. This allow us to investigate notions of the socium for space and time oriented towards cosmos and cosmogonic world models.

33. Stoeva P., S. Kuzin, A. Stoev, Y. Shopov, B. Benev A. Pertsov, November 14, 2012 total solar eclipse observation from Cairns, Australia: scientific programme and first results, Eight Scientific Conference Dedicated to 40 years of Bulgaria in space SPACE, ECOLOGY, SAFETY, December 4 - 6, 2012, Sofia 2013, pp. 69 – 75, ISSN 1313-3888.

In this work, results from the scientific expedition to Australia, for observation of the November 14, 2012 total solar eclipse are considered. Experiments for solving astrometric and heliophysical tasks, tasks in the field of sun-earth relations were conducted in the region of Mount Molloy, 150km from Palm Cove, Cairns, Queensland.

Solar corona in white-light was observed with 300 mm objective and 2000 mm Macsutov-Cassegrain telescope. Photos are made with different exposures – short for the inner corona and long for the outer corona. Thus, we derive a composite image and can investigate structure of the white light solar corona.

During the eclipse, atmospheric response was investigated using measurements of the temperature of the air at a height of 2m, pressure, humidity and wind speed and direction made with an automatic meteorological station.

Absolute illuminance of the sky during the eclipse was measured by a photometer in the region of zenith.

Trial magnetometric observations were also conducted for investigation of possible reaction of the ground magnetic field to the total solar eclipse.

Observations of the November 14, 2012 total solar eclipse give us the possibility to investigate solar corona structure during this unique minimal maximum of the solar activity cycle and compare it with previous observations during different phases of the solar cycle.

34. Stoev Alexey, Penka Stoeva, Boyan Benev, Alexander Mikhalev, 2016, Solar - atmospheric interactions over territories occupied by Karst geosystems, Eleventh Scientific Conference with International Participation - Space, Ecology, Safety November 4-6, 2015, Sofia, <http://space.bas.bg/>, p 100.

Research on the air temperature course of the of ground atmospheric layer, located near the entrances of four show caves - Saeva dupka, Ledenika, Snezhanka and Uhlovitsa for the 1968 - 2014 period is presented in this work. The data are derived within the detailed micro-climatic monitoring of the caves and Karst areas at which they are developed.

Mean annual Sunspot Number and Apmax indices of solar and geomagnetic activity have been taken from the National Geophysical Data Centre, Boulder, CO.

It was found that different lengths of solar cycles and different lengths of the upstream and downstream part of the curve complicate coordination of the duration of one cycle to another.

Just because of this, procedure was used to bring the individual solar cycles to a standard using the years of maximum and minimum as a reference points. The adjusted to one length cycles were divided into 10 phase intervals. All the data were normalized in such a way that in the course of every 11 years solar cycle, the maximum value of the studied variable by module was equal to one.

The results of the research showed that there is a positive correlation between the deviations of the average annual, summer and autumn temperatures of the Karst regions and solar activity in western phase of the quasi biannual variations. Periods with eastern phase correlation practically absent from the annual seasonal distribution of temperatures. The average annual temperatures in the four caves reach their maximum three years after the peak of solar activity. Negative correlations between the values of temperatures and Sunspot Number and Apmax are observed in winter and spring.

35. Стоев А., Стоева П., 2017, Астрономически наблюдения с изследователски характер при интегриране на знания по астрономия и астрофизика, 45-та

Национална конференция по въпросите на обучението по физика: „Експериментът - основа на образованието по физика”, 6 - 9 април 2017 г., София, Херон пресс ООД, София, ММХVII, стр. 194 – 197, ISBN 978-954-580-369-3.

Получаването на астрономически знания извън училище, чрез използването на различни видове астрономически наблюдения днес е особено актуално. Показана е възможността чрез изследователски астрономически наблюдения да се интегрира науката астрономия в системата на допълнително научно образование и развиване на творческите способности на учениците.

36. Penka Malgova, Alexey Stoev, Sergey Kusin, Beshir Marzouk, Andrey Pertsov, Mohamed Semeida, 2017, **The great American eclipse on August 21, 2017 - observations and results**, Proceedings of the Thirteenth International Scientific Conference dedicated to the 60-th Anniversary of the First Artificial Satellite of the Earth and 45 Years of Bulgaria in Space, SPACE, ECOLOGY, SAFETY, SES 2017, 2 – 4 November 2017, Sofia, Bulgaria, pp 89-94, ISSN 1313-3888.

The program of the scientific expedition for observation of the Great American total solar eclipse on August 21, 2017 is considered. It has been jointly prepared with specialists from the Russian, French and Egyptian Academy of Sciences. The observational equipment was located in the area of the town St. Joseph, USA, near the Missouri River.

For the investigations of the white light and monochromatic corona, atmospheric response during the eclipse and variations of the sky illumination were provided telescopes - 130/2,000 (Macsutov-Cassegrain) and 80/840 refractor, narrow-band green filter ($\lambda = 5303\text{\AA}$), EOS Canon cameras, meteorological conditions and skylight, luxmeters, videocamers, automatic climate control station and computers.

Total solar eclipse on August 21, 2017 has been the first in the United States since 99 years and crosses the country from Oregon to South Carolina. We partly managed to observe the phenomenon due to suddenly changed weather conditions, but we received wonderful photographs from our American and French colleagues.

37. Semeida M.A., S. S. Khodairy, M. S. El Hadidy, R. H. A. Hamed, S. M. A. Youssef, P. Stoeva, A. Stoev, 2018, **Examination of the relationship between solar activity and earth seismicity during the weak solar cycle 23**, Aerospace Research in Bulgaria (in press).

The relations between sunspot number, sunspot areas, solar 10.7 cm radio flux, solar proton events and earthquakes of magnitude $M \geq 5$ and $M \geq 8$ during the interval from 1996 to 2008 of the solar cycle 23 have been analyzed in this work. We have found that there is a direct relation between solar activity and Earth seismic activity for $M \geq 5$ and $M \geq 8$, near the maximum of the Solar cycle 23, and an inverse relation between them at the descending phase of the cycle.

04.07.2018 г.
Стара Загора

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