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Director – Dr. Habil. *Gediminas Juzeliūnas*

STAFF

8 teachers (incl. 8 holding research degree), 57 research fellows (51 holding research degree), 10 doctoral students.

Professors: Prof. Dr. E. Anisimovas (part-time), Dr. A. Kučinskas (part-time), Prof. Dr. (HP) V. Vansevičius (part-time).

Research professors: Habil. Dr. A. Bartkevičius (affiliated), Dr. K.Černis, Dr. A. Deltuva, Habil. Dr. Prof. G. Gaigalas, Dr. (HP) V. Gontis, Doc. Dr. V. Jonauskas, Habil. Dr. G. Juzeliūnas, Habil. Dr. R. Karazija (affiliated), Habil. Dr. B. Kaulakys, Dr. A. Kučinskas, Dr. J. Ruseckas, Habil. Dr. Emeritus V. Straižys, Habil. Dr. G. Tautvaišienė, Habil. Dr. K. Zdanavičius (affiliated).

Associate professors: Dr. A. Bridžius (part-time), Dr. T. Gajdosik, Dr. D. Narbutis (part-time), Dr. R. Stonkutė (part-time), Dr. K. Zubovas (part-time).

Senior research fellows: Doc. Dr. A. Acus, Dr. R. Janulis, Dr. A. Juodagalvis , Habil. Dr. V. Gineitytė (affiliated), Dr. R. Karpuškienė, Dr. A. Kazlauskas, Dr. R. Kisielius, Dr. S. Kučas, Dr. A. Kupliauskienė, Prof. Dr. (HP) E. Norvaišas, Dr. E. Pakštienė, Dr. V. Regelskis, Dr. J. Sperauskas, Dr. D. Šatkovskienė (affiliated) , Dr. J. Tamulienė, Dr. A. Vektarienė, Dr. G. Vektaris, Dr. J. Zdanavičius.

Research fellows: Dr. J. Armaitis (also Marie Currie Fellow), Dr. Y. Chorniy , Dr. V. Čepas (part-time), Dr. V. Dobrovolskas, Dr. A. Drazdauskas, Dr. D. Jurčiukonis, Dr. R. Juršėnas, Dr. H. R. Hamedi, Dr. A. Kynienė, Dr. A. Kononovičius, Dr. V. Kudriašov (part-time), Dr. Š. Masys, Dr. M. Maskoliūnas, Dr. Š. Mikolaitis, Dr. R. Minkevičiūtė, Dr. A. Mekys (part-time), Dr. A. Momkauskaitė, Dr. V. Novičenko, Dr. L. Radžiūtė, Dr. P. Rynkun, Dr. E. Stonkutė, Dr. V. Šimonis.

Junior research fellows: T. Andrijauskas, A. Černiauskas, V. Deveikis, Dr. V. Juknevičius (part-time), Dr. R. Kazakevičius (part-time), Dr. J. Klevas , M. Macijauskas (part-time), K. Milašius (part-time), S. Raudeliūnas (part-time).

Doctoral students: J. Bialopetravičius, V. Dūdėnas, G. Kerevičius, E. Kolomiecas, J. Koncevičiūtė, Ž. Misikonytė, S. Pakalka, M. Račiūnas, C. Viiscasillas Vazquez, G. Žlabys.

Lecturer: S. Lovčikas.

Engineer: M. Račiūnas (part-time)

Technicians: V. Bagdonas (part-time), L. Klebonas (part-time), G. Žlabys (part-time).

DOCTORAL DISSERTATIONS MAINTAINED IN 2017

D. Prakapavičius. Oxygen in stellar atmospheres: spectral line formation and abundances.
J. Klevas. The influence of convection and non-local radiative field on spectral line formation in stellar atmospheres.
R. Kazakevičius. Complex nonlinear systems affected by colored and non-Gaussian external noise.
H. R. Hamedi. Linear and non-linear phenomena for slow light.
V. Juknevičius. Spatio-temporal behavior in continuum surface growth models.
L. Radžiūtė. Research on parity and time-reversal violation in atomic physics.

MAIN CONFERENCES ORGANIZED IN 2017

International conference „Accelerating ERA development by promotion of gender eqality in STEM research" , November 20-21, 2017, Vilnius, http://www.acceleratingera.vu.lt/

2nd Taiwan, Lithuania, and Latvia Workshop on Quantum and Nonlinear Optics with Rydberg-State Atoms", July 10-12, 2017, Vilnius. http://www.tll2017.tfai.vu.lt/

MAIN SCIENTIFIC ACHIEVEMENTS IN 2017

It was shown for the first time that in the presence of a three-dimensional spin-orbit coupling of the Weyl type, a transverse spin current is generated in response to either a constant spin-independent force or a time-dependent Zeeman field pointing in an arbitrary direction. The paper summarizing these results was marked as an Editor's Choice paper of the international journal "Physics Review A".

We constructed a first 3D hydrodynamical model of a red giant star with the chromosphere. We have shown that shock waves propagating in the chromosphere alter the intensity and shape of the chromospheric spectral line profiles, and lead to a significantly higher flux in the UV. These properties can not be recovered using classical 1D hydrostatic model atmospheres. The obtained results demonstrate that chromospheres are prominent in red giant stars and play an important role in shaping their observable properties. The paper summarizing these results was marked as a Highlight Paper of the international journal "Astronomy and Astrophysics".

From large scale systematic multiconfiguration Dirac-Hartree-Fock calculations of the low 3C=3D f-value ratio in Fe XVII, it was proved that the low experimental 3C=3D f-value ratio

in Fe XVII presented in the publications by S. Bernitt et al. in “Nature” 492, 225 (2012) was wrong. Also it was determined that the theoretical investigation of this ratio presented in the Phys. Rev. Lett. 118, 163002 (2017) was incorrect due to a limited and unbalanced treatment of correlation, and the methods used to correct it led to unreliable results for the f(3C)=f(3D) ratio.

RESEARCH AREAS

Analysis of Atoms, Subatomic Particles or their Ensembles, Complex Systems, Electromagnetic Radiation and Cosmic Objects.

RESEARCH INTERESTS

Galactic structure and chemodynamical evolution

Chemical composition and mixing phenomena in stellar atmospheres

Hydrodynamical phenomena and non-equilibrium radiative transfer in stellar atmospheres

Stellar asteroseismology

Planet hosting stars and exoplanet transits

Structure and evolution of galaxies

Search and positional observations of comets and asteroids

Theoretical atomic spectroscopy

Quantum many-body theory

Algorithms and computer programs for plasma physics, astrophysics and other fields

Application of quantum mechanics and electrodynamics for transitions in atoms, molecules and molecular complexes

Interactions of atoms and molecules with electrons and radiation

Spectroscopic characteristics of the molecular compounds

Theoretical investigation of crystalline and electronic structure of perovskite crystals

Development of algebraic techniques for nuclear and particle physics

Investigation of electroweak vector bosons in pp collisions

Investigation of scattering processes in few-body nuclear systems
Quantum optics and ultra-cold atoms

Bose-Einstein condensates

Condensed matter systems

Quantum chemistry

Condensed molecular structures

Econophysics and physics of finance

Fluctuations and noise, theory of 1/f noise

RESEARCH PROJECTS CARRIED OUT IN 2017

Projects Supported by University Budget

Stellar chemical composition and asteroseismic activity in the Milky Way Galaxy. Dr. Habil. G. Tautvaišienė. 2016–2020.

We studied the chemical evolution of the thick and thin discs of the Galaxy and concluded that the thick disc has formed on a time-scale of accretion of 0.1 Gyr, whereas the thin disc formed on a time-scale of 7 Gyr in the solar region. A gap in star formation between the thick and thin disc formation of several hundreds of Myr should be present. We also studied the lithium, sulphur, and zinc enrichment histories of the Galactic thick and thin discs as well as the metallicity dependence of the [Y/Mg]-age relation for solar-type stars. Using the Moletai Astronomical Observatory telescopes, we studied the exoplanet hosting star HAT-P-23 and found two new exoplanets of hot-jupiter type rotating around it.

Main publications:

Grisoni, V., Spitoni, E., Matteucci, F., Recio-Blanco, A., de Laverny, P., Hayden, M., Mikolaitis, Š., and Worley, C. C. The AMBRE project: chemical evolution models for the Milky Way thick and thin discs. Monthly Notices of the Royal Astronomical Society, 472, 3637-3647 (2017).

Hayden, M. R., Recio-Blanco, A., de Laverny, P., Mikolaitis, S., and Worley, C. C. The AMBRE project: The thick thin disk and thin thick disk of the Milky Way, Astronomy & Astrophysics, Volume 608, id.L1, 5 pp. (2017)

Feltzing, S.; Howes, L. M.; McMillan, P. J.; Stonkutė, E. On the metallicity dependence of the [Y/Mg]-age relation for solar-type stars, Monthly Notices of the Royal Astronomical Society: Letters, 465, L109-L113.

Star formation and dust clouds in the Orion and Perseus arms of the Galaxy. Prof. V. Straižys. 2016–2020.

Interstellar extinction in the direction of dark clouds TGU H989 P2 and TGU H989 P3 within the dust ring in Camelopardalis and containing the open cluster King 7, was investigated using about 960 stars observed in the seven-colour Vilnius system and the 2MASS and WISE infrared photometric systems. Spectral and luminosity classes, interstellar reddenings and distances were determined. Dust distribution in the area was compared to the distribution of molecules CO taken from the Dame et al. Survey. The Gaia Data Release 1 prallaxes were applied for determination of distances. 80 young stellar objects have been discovered. In the area of young open cluster NGC 2264 the catalogue of young stellar objects, containing about 600 objects, was analysed to determine the cluster membership, interstellar reddenings, extinctions and ages.

Main publications:

Straižys, V., Čepas, V., Boyle, R.P., Zdanavičius, J., Zdanavičius, K., Maskoliūnas, M., Kazlauskas, A., Černis, K. and Macijauskas, M. 2017. Dust and molecular clouds in the vicinity of the open cluster King 7: interstellar extinction and distances, submitted to Astronomy and Astrophysics journal.

Hydrodynamical phenomena and radiative transfer in stellar atmospheres. Dr. A. Kučinskas. 2015–2019.

An in-depth study of the formation of OH UV spectral lines in the atmosphere of a metal-poor red giant star HD 122563 was carried out using 3D hydrodynamical CO^5BOLD model atmosphere. It was shown that the formation OH UV lines are prone to large 3D effects, besides, chromospheric layers play an important role in the formation of these lines. Because of this, oxygen abundances obtained using 3D hydrodynamical model atmosphere and different oxygen abundance indicators (OH UV & IR lines, the forbidden [O I] line) are more accurate and reliable than those determined using classical 1D hydrostatic model atmospheres.

Main publications:

Prakapavičius, D., Kučinskas, A., Dobrovolskas, V., Klevas, J., Steffen, M., Bonifacio, P., Ludwig, H.-G., Spite, M. 2017. Three-dimensional hydrodynamical CO5BOLD model atmospheres of red giant stars. V. Oxygen abundance in the metal-poor giant HD 122563 from OH UV lines, Astronomy & Astrophysics, 599, A128.

Stochastic Effects in Stellar Systems. Prof. Dr. (HP) V. Vansevičius. 2014–2018.

A detailed study of the Leo A galaxy was performed using ground (Subaru, National Astronomical Observatory of Japan) and space based observations (Hubble Space Telescope). Spatially resolved star formation history of Leo A galaxy was derived. Evolutionary parameters of 1363 star clusters in the Andromeda galaxy were determined based on Hubble Space Telescope photometric observations. 336 radial velocity observations of K-M dwarfs in the solar vicinity were performed using VUES spectrograph at the Molėtai Astronomical Observatory. Variability periods of 7 PPNe stars (35-135 days) were derived based on 1517 radial velocity measurements and it was demonstrated that all monitored PPNe do not have secondary components more massive than 0.2 solar masses. We determined the properties of turbulent gas and its fragmentation in galaxy bulges subjected to AGN feedback, discovered that AGN seem to have a critical luminosity which gives the strongest enhancement of star formation in the host galaxy.

Main publications:

de Meulenaer, P., Stonkutė, R., Vansevičius, V. 2017. Deriving physical parameters of unresolved star clusters. V. M 31 PHAT star clusters. Astronomy and Astrophysics, 602, A112.

Hrivnak, B.J., Van de Steene, G., Van Winckel, H., Sperauskas, J., Bohlender, D., Lu, W. 2017. Where are the Binaries? Results of a Long-term Search for Radial Velocity Binaries in Proto-planetary Nebulae. Astrophysical Journal, 846:96.

Zubovas, K., Bourne, M. A. 2017. Do AGN outflows quench or enhance star formation? Monthly Notices of the Royal Astronomical Society, 468, 4956-4967.

Astrometry and photometry of small Solar-system bodies. Dr. K. Černis. 2016–2020.

Twenty-seven new asteroids have been discovered. A new precise orbit of the Distant object (463368) 2012 VU85 was determined. Precise orbits were calculated for our earlier discovered 99 objects at the Molėtai Observatory in 2010–2012. We published 5759 astrometric positions

of 1383 asteroids. Near Earth Objects, TNO, Main Belt, Centaurs asteroids and comets were observed with the 0.35/0.51 m Maksutov telescope (Molėtai Observatory), with the 0.80/1.20 m Schmidt telescope (Baldone Observatory, Latvia), and with the 1.8 m Vatican telescope (Mt. Graham, Arizona, U.S.A.). Five asteroids were named by Steponas Darius, Stasys Girėnas, Kučinskas, Bridžius and Trakai.

Main publications:

Wlodarczyk, I., Černis, K., Boyle, R. 2017. Discovery, orbit and orbital evolution of the Distant object (463368) 2012 VU85. Acta Astron. 67, 81-102.

Wlodarczyk, I., Černis, K., Zdanavičius J. 2017. Observational data and orbits of the asteroids discovered at the Molėtai Observatory in 2010-2012. Open Astron. 26, 35-45.

Černis, K. Astrometric observations of 22 asteroids (87 positions) in Molėtai Astronomical Observatory (Code 152). *M.P.C.* 103152 (2017 Mar. 12).

Investigation of the spectroscopic characteristics of complex atoms and their derivatives. Dr. A. Kupliauskienė. 2012–2018.

The energies and electron-impact excitation cross sections of Sr ion from 4p subshell are calculated in the Dirac-Fock-Slater approximation. The classification of calculated energy levels is performed. The intensity spectrum of the Auger lines of Sr ion emitted following 4p-electron impact excitation of Sr atom via simultaneous ionization and excitation as well as excitation-autoionization processes is evaluated and used for the identification of experimental spectrum. The spectroscopic parameters of configurations $4p^6 4d^3$, $4p^5 4d^6$, and $4p^6 4d^4 f$ of ion W^{33-} are calculated using the quasi-relativistic approach. Relativistic spin-photon (or else AME) interaction term is written in irreducible tensor form, provided that the radiation source is described by electronic transitions. As a result, it is shown that the atomic energy corrections increase for shortwavelengths (such as eg. 21 Å or shorter wavelengths of satellite lines) and large charge number. The most probable fragmentation pathways of the glutamate were determined. The structure and composition of the fragments were established.

Main publications:

A. Kupliauskienė, G. Kerevičius, V. Borovik, I. Shafranyosh, A. Borovik. The energy structure and decay channels of the $4p^6$-shell excited sttaes in Sr. J. Phys. B: At. Mol. Opt. Phys. **50**, 225201 (2017).

J. Tamulienė, J. Noll, P. Frenzel, T. Rüffer, A. Jakob, B. Walfort and H. Lang, Synthesis of [{AgO 2 CCH 2OMe(PPh 3)} n] and theoretical study of its use in focused electron beam induced deposition, Beilstein J. Nanotechnol. **8**, 2615 (2017).

R. Juršėnas, Irreducible tensor form for the spin-photon coupling, Physics Letters A **381**, 3295 (2017)

Investigation of ordered and unordered atomic systems. Dr. V. Jonauskas. 2014–2018.

It is shown that triple ionization (TI) of the Se2+ ion is mainly formed in two ways: (i) Auger cascade following single ionization of the 3p shell and (ii) direct double ionization with subsequent autoionization. The study reveals negligible contribution of the direct TI by electron-impact to the process. Single ionization by electron impact of the Se3+ ion is

investigated in the Dirac-Fock-Slater approximation. Contributions from direct ionization, excitation-autoionization, and resonant-excitation double-autoionization processes are taken into account. It is shown that ionization-ionization and ionization-excitation-ionization processes can play the significant role in the double ionization of Se3+ ions. The first-principles calculations performed within the hybrid density functional theory scheme indicate that under weak tensile strain SrRuO3 thin films prefer the Cmcm rather than the I4/mmm lattice, allowing to conclusively dispel the uncertainty the experimentalists have previously dealt with while trying to identify the crystalline structure of tensile strained SrRuO3.

Main publications:

Š. Masys, V. Jonauskas. The crystalline structure of SrRuO3: Application of hybrid scheme to the density functionals revised for solids. Lith. J. Phys. 57, 78 (2017).

F.H. Cashman, V.P. Kulkarni, R. Kisielius, G.J. Ferland, P. Bogdanovich. Atomic Data Revisions for Transitions Relevant to Observations of Interstellar, Circumgalactic, and Intergalactic Matter. The Astrophysical Journal Supplement Series, 230, 8 (2017).

K.M. Aggarwal, P. Bogdanovich, F.P. Keenan, R. Kisielius. Energy levels and radiative rates for transitions in Fe V, Co VI and Ni VII. Atomic Data and Nuclear Data Tables, 114, 1 (2017).

Correlaton and relativistic effects in complex atoms and ions. Prof. G. Gaigalas. 2015–2019.

Employing multiconfiguration Dirac–Hartree–Fock method the excitation energies and lifetimes for the lowest 200 states and multipole transition data among these states are calculated for O-like ion, from Cr XVII to Zn XXIII. The data are useful for identification and deblending of new emission lines from the Sun and other astrophysical sources. The amount data is significantly increased for the n=3 states of several O-like ions of astrophysical interest, where experimental data are very scarce.

Main publications:

K. Wang, P. Jönsson, J. Ekman, T. Brage, Ch. Y. Chen, Ch. F. Fischer, G. Gaigalas, M. Godefroid. Comment on "Theoretical Confirmation of the Low Experimental 3C/3D f-Value Ratio in Fe XVII", Phys. Rev. Lett. **119**, 189301 (2017).

K. Wang, P. Jönsson, J. Ekman, G. Gaigalas, M.R. Godefroid, R. Si, Z.B. Chen, S. Li, C. Y. Chen, J. Yan. Extended Calculations of Spectroscopic Data: Energy Levels, Lifetimes, and Transition Rates for O-like Ions from Cr XVII to Zn XXIII, Astrophysical Journal Supplement Series **229**, 37 (2017).

L. Filippin, J. Bieroń, G. Gaigalas, M. Godefroid, P. Jönsson. Multiconfiguration Calculations of electronic isotope-shift factors in Zn I, Phys. Rev. A. **96**, 0042502 (2017).

Theoretical Study of Light Nuclei and Elementary Particles. Dr. A. Deltuva. 2016–2020.

Nucleon transfer reactions in deuteron-deuteron collisions above breakup threshold were studied solving exact integral equations for four-body transition operators; differential cross sections, analyzing powers, and spin transfer coefficients calculated using realistic NN force models were found to be in good agreement with experimental data. Universal properties of the four fermion system near the unitary limit have been determined, in particular, the parameters of the effective range expansion for the fermionic dimer-dimer scattering. Magnetic moments and magnetic dipole transition widths of all ground-state heavy hadrons were studied within a framework of the modified bag model. For the baryons containing three differently flavoured quarks the effect of hyperfine mixing was taken into account. In order to minimize uncertainties in the calculation of the decay widths the additional care was taken to improve theoretical predictions for the energy of emitted photon (when available, the experimental data were used).

Main publications:

A. Deltuva, A. C. Fonseca, Four-body calculation of ^{2}H(d,p)^{3}H and ^{2}H(d,n)^{3}He reactions above breakup threshold, Phys. Rev. C 95, 024003 (2017).

A. Deltuva, Universality in fermionic dimer-dimer scattering, Phys. Rev. A 96, 022701 (2017).

A. Dargys, A. Acus, Calculation of Quantum Eigens with Geometrical Algebra Rotors, Advances in Applied Clifford Algebras 27 (1), 2017, p. 241-253, doi:10.1007/s00006-015-0549-6.

Optical and Kinetic Properties of Cold Atoms and Condensed Molecular Structures. Habil. Dr. G. Juzeliūnas, 2011–2017.

Propagation of a probe pulse was considered in an atomic medium characterized by a combined tripod and Lambda atom-light coupling scheme. It is demonstrated that dark states can be formed for such an atom-light coupling leading to the electromagnetic transparency and slow light. It is shown that generation of stable slow light optical solitons is possible in such a combined tripod and Lambda atomic system. An optical bistability was demonstrated for a four-level atomic system involving a Rydberg state illuminated by a probe and control laser fields. A way of creating the spin-orbit coupling in atomic-molecular Bose-Einstein condensates was demonstrated by combining the spin-dependent photoassociation and Raman coupling, which can lead to formation of topological excitations.

Main publications:

H.R. Hamedi, J. Ruseckas and G. Juzeliūnas, Electromagnetically induced transparency and nonlinear pulse propagation in a combined tripod and Λ atom-light coupling scheme, J. Phys. B. **50**, 185401 (2017).

H.R. Hamedi, M. Sahrai, H. Khoshsima and Juzeliūnas, Optical bistability forming due to a Rydberg state, J. Opt. Soc. Am B. **34**, 1923 (2017).

C.F. Liu, G. Juzeliūnas and W. M. Liu, Spin-orbit coupling manipulating composite topological spin textures in atomic-molecular Bose-Einstein condensates, Phys. Rev. A **95**, 023624 (2017).

Evolution and Statistics of Complex Systems Prof. B. Kaulakys. 2017–2021.

We have studied burst and inter-burst duration statistics as empirical test of a long-range memory in the financial markets. The concept of spurious memory in the non-equilibrium stochastic models of imitative behavior, based on the non-linear stochastic differential

equations, is developed. We have shown that Forex data with high probability exhibits spurious memory as empirical burst and inter-burst duration statistics can be reproduced by proposed model with Markov property. We have studied statistics of the Lithuanian parliamentary elections and shown that these statistics could arise from a simple herding model, which is also used in our works related to a long-range memory in the financial markets. We have shown that both Forex and our model of financial markets both exhibit spurious long-range memory.

Main publications:

V. Gontis and A. Kononovicius. Burst and inter-burst duration statistics as empirical test of long-range memory in the financial markets. Physica A **483**, 266 (2017).

A. Kononovicius, Empirical analysis and agent-based modeling of Lithuanian parliamentary elections, Complexity **2017**, 7354642 (2017).

V. Gontis and A. Kononovicius, Spurious memory in non-equilibrium stochastic models of imitative behavior, Entropy **19**, 387 (2017).

National Research Projects

Research Council of Lithuania. **Spectroscopic and Photometric Survey of Northern Sky for the ESA PLATO space mission** (LAT-16019). Dr. Š. Mikolaitis. 2016 – 2018.

The PLATO Space Observatory of the European Space Agency is expected to find exoplanets that could be similar to planets in our solar system. To accurately access the properties of the planets, scientists have to know as much as possible about the star the planet is orbiting. We are acquiring this information (surface temperature, gravity, metallicity, chemical composition, variability information) for the northern PLATO fields using spectroscopic and photometric infrastructure at the Molėtai Astronomical Observatory, VU ITPA. High-resolution spectral observations have been carried out for 213 stars and photometric variability light curves obtained for 3604 stars.

Main publications:

Mikolaitis Š.; de Laverny, P.; Recio-Blanco, A.; Hill, V.; Worley, C. C.; de Pascale, M., The AMBRE project: Iron-peak elements in the solar neighbourhood, Astronomy & Astrophysics, Volume 600, id.A22 (2017).

Mikolaitis Š., Tautvaišiene, G., Drazdauskas, A., Minkevičiūtė, R., Klebonas, L., Bagdonas, V., Pakštienė, E., Janulis, R., Spectroscopic and photometric survey of the northern sky: I. Detailed chemical composition of 140 stars, 2017, submitted to Astronomy & Astrophysics

E. Pakštienė, R. Janulis, G. Tautvaišienė, A. Drazdauskas, L. Klebonas, Š. Mikolaitis, R. Minkevičiūtė, V. Bagdonas, Variability analysis of thirteen delta Scuti candidate stars, 2017, submitted to Astronomy & Astrophysics

Research Council of Lithuania. **Towards realistic stellar model atmospheres: magnetic fields, molecules, and non-equilibrium radiative transfer in stellar atmospheres** (MIP–089/2015). Dr. A. Kučinskas. 2015 – 2018.

We constructed a first 3D hydrodynamical model of a red giant star with the chromosphere. We have shown that shock waves propagating in the chromosphere alter the intensity and shape of the chromospheric spectral line profiles, and lead to a significantly higher flux in the

UV. These properties can not be recovered using classical 1D hydrostatic model atmospheres. The obtained results demonstrate that chromospheres are prominent in red giant stars and play an important role in shaping their observable properties. We have also discovered that stars belonging to different stellar generations in the globular cluster 47 Tuc have very similar potassium abundance. We found no statistically significant relations between the abundances of potassium and other light elements, such as sodium and magnesium. Also, there were no abundance trends with the distance from the cluster center, nor any statistically significant relations between the abundance/abundance ratios and absolute radial velocities of individual stars. All these facts suggest the similarity of K abundance in stars that belong to different generations in 47 Tuc which, in turn, may hint that evolution of K in this particular cluster was unrelated to the nucleosynthesis of Na and/or Mg.

Main publications:

S. Wedemeyer, A. Kučinskas, J. Klevas, H.-G. Ludwig, Three-dimensional hydrodynamical CO5BOLD model atmospheres of red giant stars VI. First chromosphere model of a late-type giant, Astronomy & Astrophysics, 606, A26 (2017)(Astronomy and Astrophysics Highlight Paper)

A. Černiauskas, A. Kučinskas, J. Klevas, D. Prakapavičius, S. Korotin, P. Bonifacio, H.-G. Ludwig, E. Caffau, M. Steffen, Abundances of Na, Mg, and K in the atmospheres of RGB stars of Galactic globular cluster 47 Tucanae, Astronomy & Astrophysics, 604, A35 (2017)

Research Council of Lithuania. **Spectroscopic survey of carbon, nitrogen and oxygen in stars of the Galactic open clusters** (MIP-082/2015). Dr. Habil. G. Tautvaišienė. 2015 – 2018.

We traced the radial distributions of abundances of chemical elements produced through different nucleosynthetic channels – the alpha-elements O, Mg, Si, Ca and Ti, and the iron-peak elements Fe, Cr, Ni and Sc – by use of the Gaia-ESO IDR4 results for open clusters and young-field stars. We found that the chemo-dynamical model, with the new generation of metallicity-dependent stellar yields for massive stars, is able to reproduce the observed spatial distributions of abundance ratios, in particular the abundance ratios of [O/Fe] and [Mg/Fe] in the inner disc (5 kpc < RGC < 7 kpc), with their differences, that were usually poorly explained by chemical evolution models.

Main publications:

Tang, B., …Tautvaišienė, G., Drazdauskas, A., Ženovienė, R. et al. The Gaia-ESO survey: the inner disk intermediate-age open cluster NGC 6802. Astronomy & Astrophysics, Volume 601, id.A56, 16 pp. (2017)

Magrini. L., …Tautvaišienė, G. et al. The Gaia-ESO Survey: radial distribution of abundances in the Galactic disc from open clusters and young-field stars, Astronomy & Astrophysics, Volume 603, id.A2, 20 pp. (2017)

Research Council of Lithuania. **Theoretical study of three-particle nuclear reactions** (No. MIP-094/2015). Dr. A. Deltuva. 2015–2017.

Nuclear reactions in systems consisting of two nucleons and nuclear core were described using exact three-body Faddeev theory for transition operators in the momentum-space partial-wave representation. ^{20}O(d,p)^{21}O transfer reactions were described including the vibrational excitation of the ^{20}O core. The experimental cross section data at 10.5

MeV/nucleon beam energy for the ^{21}O ground state 5/2+ and excited state 1/2+ were quite well reproduced by the calculations with the core excitation. At higher energies core-excitation effects were found to be very different for reactions with the orbital angular momentum transfer l = 0 and l = 2, suppressing the cross sections for the former and enhancing for the latter.
Low-energy neutron–^{19}C scattering was studied in the three-body n + n + ^{18}C model using a realistic nn potential and a number of shallow and deep n–^{18}C potentials. For the elastic n–^{19}C scattering in the J = 0+ partial wave the signatures of the Efimov physics were confirmed for both shallow and deep models, but with clear quantitative differences between them, indicating the importance of a proper treatment of deeply-bound Pauli-forbidden states.

Main publications:

A. Deltuva, D. Jurčiukonis, E. Norvaišas, Core-excitation effects in ^{20}O(d,p)^{21}O transfer reactions: Suppression or enhancement? Phys. Lett. B 769, 202 (2017).
A. Deltuva, Neutron-^{19}C scattering: Towards including realistic interactions, Phys. Lett.B 772, 657 (2017).

Research Council of Lithuania. **Novel Optical Lattices** (No. MIP-86/2015). Dr. Habil. G. Juzeliūnas. 2015–2018.

Superfluidity properties have been investigated for degenerate gas of Fermi of atoms in a laser-assisted bilayer system providing the two-dimensional spin-orbit coupling (SOC). It is demonstrated that a Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) state appears in the regime of small to moderate atom-light coupling. In contrast to the ordinary SOC, the FFLO state emerges in the bilayer system without adding any external fields or spin polarization. As the atom-light coupling increases, the system can transit from the FFLO state to a topological superfluid state. These findings are confirmed by the Bogoliubov-de Gennes simulations with a weak harmonic trap added.

Main publications:

L. L. Wang, Q. Sun, W.M. Liu, G. Juzeliūnas and A.C. Ji, Fulde-Ferrell-Larkin-Ovchinnikov state to topological superfluidity transition in bilayer spin-orbit-coupled degenerate Fermi gases. Phys. Rev. A **95**, 053628 (2017).

Research Council of Lithuania. **Quantum phases and phase transitions in restricted-geometry condensates** (No. APP-4/2016). Prof. dr. E. Anisimovas. 2016–2019.

During 2017, the project continued its activities, focusing on Floquet engineering of artificial gauge fields, stabilization and detection of fractional quantum Hall states, and motion of wave packets in the presence of position-space, momentum-space and phase-space Berry curvature. In particular, it was demonstrated that in square lattices as small as 9x5 sites fractionally charged topological excitations can be induced using two complementary techniques: introduction of local potential offsets and threading a local flux tube through a single plaquette. Two papers were published in the course of the year, while a third one will be finalized for submission in early 2018.

Main publications:

V. Novičenko, E. Anisimovas and G. Juzeliūnas, Phys. Rev. A **95**, 023615 (2017).

J. Armaitis, J. Ruseckas and E. Anisimovas, Phys. Rev. A **95**, 043616 (2017).

Research Council of Lithuania**. Interstellar clouds and star forming in the Great Cygnus Rift of the Milky Way** (S-MIP–17-74). Dr. S. A. Kazlauskas. 2017 – 2019.

The goal of this project is the investigation of a group of interstellar clouds and star forming regions (SFRs) located in the direction of the Great Cygnus Rift, between the Galactic longitudes 70 – 90 deg. Using the seven-colour Vilnius photometric system as well as astrometric data from the Gaia orbiting observatory we determine the distances and interstellar extinction to several young clusters located in this region. For determination of young stellar objects (YSOs) we also use data of the infrared photometric surveys 2MASS (Two-Micron All Sky Survey) and WISE (Wide-field Infrared Survey Explorer). The preliminary results of the investigation of the open cluster IC4996 will be presented at the 231st meeting of the American Astronomical Society in January 2018.

Research Council of Lithuania postdoctoral fellowship **Physical modeling of order book and opinion dynamics** (09.3.3-LMT-K-712-02-0026). Dr. A. Kononovičius, 2017 – 2019.

The idea to apply tools from physics to social systems is not novel, but until 1980s there were mostly social scientists who took inspiration from physics and not the other way round. The first studies conducted by physicists revealed that social systems exhibit statistical patterns reminiscent of physical systems in critical state. So far, there are no "ideal" models. During the project, we will aim to move towards the "ideal" model. While working on the new models we will take compatibility with theories from social sciences as well as empirical data into account.

International Research Projects

Taiwan-Latvia-Lithuania joint research project **Quantum and Nonlinear Optics with Rydberg-State Atoms** (TAP LLT-2/2016) Dr. J. Ruseckas. 2016 – 2018.

Electromagnetically induced transparency (EIT) involving atomic Rydberg states in a more complicated double tripod level scheme has been investigated. In the double tripod scheme two probe laser fields are propagating inside the atomic medium leading to a two component (spinor) slow light. In the case of non-interacting atoms the propagation of the two-component slow light has been recently demonstrated experimentally. In comparison to previously used schemes for quantum nonlinear optics with Rydberg states, the double tripod scheme can combine spin-orbit coupling for the spinor slow light with an interaction between photons. In a ladder atom-light coupling configuration the interaction is always attractive independent from the detuning. In contrast, in the proposed scheme the interaction can become repulsive if the one-photon detunings have opposite signs. A publication on this topic was submitted to Phys. Rev. A.

Main publications:

J. Ruseckas, I. A. Yu, and G. Juzeliūnas, Creation of two-photon states via interactions between Rydberg atoms during light storage, Phys. Rev. A 95, 023807 (2017).

EU Horizon 2020 Marie Skłodowska-Curie Fellowship **Spin Transport in Interacting Spin-Orbit Coupled Systems.** Dr. J. Armaitis. 2016–2018.

We provide a theoretical description of these novel interacting spin-orbit coupled systems. More concretely, we derive equations describing the motion of spin and mass, and solve these

equations. We investigate spin transport in the uncharted regime where the inter-particle interactions compete with spin-orbit coupling.

Main publications:

J. Armaitis, J. Ruseckas, H. T. C. Stoof, and R. A. Duine, Spin Hall mode in a trapped thermal Rashba gas, Phys. Rev. A **96**, 053625 (2017).

J. Armaitis and R. A. Duine, Superfluidity and spin superfluidity in spinor Bose gases, Phys. Rev. A **95**, 053607 (2017)

J. Armaitis, J. Ruseckas, and G. Juzeliūnas, Omnidirectional spin Hall effect in a Weyl spin-orbit-coupled atomic gas, Phys. Rev. A **95**, 033635 (2017).

Lithuanian Academy of Sciences. **Lithuanian cooperation with CERN.** Dr. A. Juodagalvis, since 2008.

Activities at the Compact Muon Solenoid (CMS) experiment at CERN focused on the Drell-Yan process measurement in proton collisions at the center-of-mass energy of 13 TeV recorded in 2015. The measurement is nearly completed, the analysis is entering the collaboration-wide-review (CWR) stage (prior to submission to a journal). Participation in the CMS muon system upgrade project GEM was continued. It focused on GEM construction database development and data integration into CMSSW and the global CMS condition database. DCS shifts in P5 were carried out.

A study of the Grimus-Neufeld model was continued. It is an extended Standard model with one additional Higgs doublet and one heavy right-handed Majorana neutrino. In this model, the light neutrinos acquire masses through the seesaw mechanism coupled to radiative corrections. A presentation at the XLI International conference of theoretical physics „Matter to the Deepest“ (Podlesice, Poland, September 3-8, 2017) presented current findings on comparison of the mass values obtained by an exact solution to the values given by the Grimus-Lavoura approximation.

We used applied group-theory to find and classify finite subgroups of U(3) and of SU(3). These group theoretical results can be applied to model-building, specifically to better understand the PMNS (neutrino mixing matrix).

Main publications:

CMS Collaboration, The Phase-2 Upgrade of the CMS Muon Detectors, Technical design report, CERN-LHCC-2017-012 (12 Sept 2017), 376 pp.

D. Jurčiukonis, L. Lavoura, Group-theoretical search for rows or columns of the lepton mixing matrix, J.Phys. G44 no.4, 045003 (2017).

D. Jurčiukonis, L. Lavoura, GAP listing of the finite subgroups of U(3) of order smaller than 2000, PTEP 2017 no.5, 053A03 (2017).

International programme **Gaia-ESO Spectroscopic Survey** (ESO project 188.B-3002). Dr. Habil. G. Tautvaišienė. 2012 – 2018.

We used the Gaia-ESO survey data to characterize the bulge metallicity distribution function (MDF), magnesium abundance, spatial distribution, and correlation of these properties with

kinematics. Moreover, the homogeneous sampling of the different Galactic populations provided by the Gaia-ESO survey allowed us to perform a comparison between the bulge, thin disk, and thick disk sequences in the [Mg/Fe] vs. [Fe/H] plane in order to constrain the extent of their eventual chemical similarities. We associate metal-rich stars with the bar boxy/peanut bulge formed as the product of secular evolution of the early thin disk. This is the first time that an analysis of the bulge MDF and α-abundances has been performed in a large area on the basis of a homogeneous, fully spectroscopic analysis of high-resolution data. We also investigated the Mg-Al anti-correlation in Galactic globular clusters and found that it is not seen in all clusters, but disappears for the less massive or most metal-rich clusters. The open cluster Trumpler 23 was investigated in detail. It is a moderately populated, intermediate-age open cluster within the solar circle at a RGC 6 kpc.

Main publications:

Rojas-Arriagada, A., Recio-Blanco, A., de Laverny, P., Mikolaitis, Š. et al., The Gaia-ESO Survey: Exploring the complex nature and origins of the Galactic bulge populations, Astronomy & Astrophysics, Volume 601, id.A140, 17 pp.

Pancino, E., Romano, D., Tang, B., Tautvaišienė, G. et al. The Gaia-ESO Survey: Mg-Al anti-correlation in iDR4 globular clusters, Astronomy & Astrophysics, Volume 601, id.A112, 10 pp.

Overbeek, J. C., …Tautvaišienė, G., …Drazdauskas, A., Ženovienė, R. et al. The Gaia-ESO Survey: the inner disk, intermediate-age open cluster Trumpler 23, Astronomy & Astrophysics, Volume 598, id.A68, 18 pp.

Long-term international project **The European Space Agency Satellite Gaia**. Prof. V. Straižys, Dr. Habil. G. Tautvaišienė.

We investigated the scientific potential and limitations of the first Gaia Data Release Tycho-Gaia Astrometric Solution (TGAS) component by means of the astrometric data for open clusters. The Gaia DR1 provides the means to examine open clusters far beyond their more easily visible cores, and can provide membership assessments based on proper motions and parallaxes. Parallaxes for 331 classical Cepheids, 31 Type II Cepheids, and 364 RR Lyrae stars in common between Gaia and the Hipparcos and Tycho-2 catalogues are published in Gaia Data Release 1. Good agreement is found from direct comparison of the parallaxes of RR Lyrae stars for which both TGAS and HST measurements are available.

Main publications:

V. Straižys and Gaia Collaboration. 2017. Gaia Data Release 1. Open cluster astrometry, A&A, 601, A19

V. Straižys and Gaia Collaboration, 2017. Gaia Data Release 1. Testing of parallaxes with local cepheids and RR Lyrae stars, A&A, 605, A79

EC Horizon2020 project "**EUROPLANET2020 – Research Infrastructure**" (project No. 654208). Dr. Habil. G. Tautvaišienė. 2015 – 2019.

We were working in the work packages dedicated to on-ground observations, coordination and training of amateur astronomers and planeary science outreachers. A summer school was organized on July 18–28, 2017, as part of the Europlanet 2020 RI NA1 (Innovation through

Science Networking) Task 5 (Coordination of ground-based observations) and Europlanet 2020 RI NA2 (Impact through outreach and engagement). The aim of the course was to give participants a thorough, multidisciplinary introduction into space missions and the ground-based observations required by space missions before and after launch, as well as an introduction to science communication. More general subjects about specific space missions (Gaia, Kepler, PLATO, TESS), planetary systems, habitability of planets, photometric and spectroscopic techniques were presented. Participants were given some hands-on experience with analysis of stellar chemical composition, detection of stellar variability and/or exoplanets using the Molėtai Astronomical Observatory telescopes (CCD photometry and high-resolution spectroscopy). In addition, the course gave participants the opportunity to develop comprehensive theoretical and practical skills in science communication and engaging with a range of lay audiences, including the public, media, policy makers, schools and educators. 21 participant from 11 countries (Azerbaijan, France, Greece, Italy, Lithuania, Spain, Sweden, Portugal, Romania, Ukraine, United Kingdom) have been trained.

Main publications:

Scherf, M., Kargl, G., Tautvaisiene, G., and Al-Ubaidi, T. Europlanet 2020: Fostering the collaboration between professional scientists and amateur astronomers. 2017, European Planetary Science Congress http://adsabs.harvard.edu/abs/2017EPSC...11..461S

Long-term international project **The Whole Earth Telescope (WET).** Dr. E. Pakštienė, Dr. R. Janulis.

On 24-31 of August (2017) we participated in multi-site campaign for observations of the central pulsating star in the planetary nebulae K1-16, as this object has never been a subject to an extensive multi-site campaign before. The aim of this asteroseismic study was to detect ε-driven pulsations in this star and to measure the evolutionary contraction of the star. We got photometric observational data with the 1.65 m telescope at the Molėtai Astronomical observatory during 6 nights.

Main publications:

Silvotti, R., Schuh, S., Kim, S.-L., Lutz, R., Reed, M., Benatti, S., Janulis, R., Lanteri, L., Ostensen, R., Marsh, T. R., Dhillon, V. S., Paparo, M., and Molnar, L. The sdB pulsating star V391 Peg and its putative giant planet revisited after 13 years of time-series photometric data. 2017, ArXiv e-prints http://adsabs.harvard.edu/abs/2017arXiv171110942S

International long-term international project **Kepler Follow-up Program of Kepler Objects of Interest (KFOP-KOIs).** Dr. E. Pakštienė, Dr. R. Janulis. Since 2016.

In 2017 we observed two Kepler Objects of Interest: KOI 0880.02 on 30 August and KOI 0759.01 on 31 Aug. The aim of the observations was looking for the Transit Timing Variation and the Transit Duration Variation (TTV/TDV), which are indication of more than one exoplanet in planetary system. Photometric observations were performed at the Moletai Astronomical Observatory with the 1.65 m telescope and Alta U47 CCD camera.

Main publications:

C. von Essen, A. Ofir, S. Dreizler, E. Agol, J. Freudenthal, J. Hernandez, S. Wedemeyer, V. Parkash, H. Deeg, S. Hoyer, B. M. Morris, A. C. Becker, L. Sun, S. H. Gu, E. Herrero, L. Tal-

Or, K. Poppenhaeger, M. Mallonn, S. Albrecht, S. Khalafinejad, P. Boumis, C. Delgado-Correal, D. Fabrycky, R. Janulis, S. Lalitha, A. Liakos, Š. Mikolaitis, M. L. Moyano D'Angelo, E. Sokov, E. Pakštienė, A. Popov, V. Krushinsky, I. Ribas, M. M. Rodrıguez S., S. Rusov, I. Sokova, G. Tautvaišienė, X. Wang, Kepler Object of Interest Network I. First results combining ground and space-based observations of Kepler systems with transit timing variations, (submitted to Astronomy&Astrophysics).

International long-term project **Gaia Science Alerts**. Dr. E. Pakštienė, Dr. R. Janulis. Since 2016.

We observed two Gaia Science Alerts objects: *gaia17bxh* was observed on 30 August, which is a suspected microlensing event, and *gaia16aye* was observed on 31 August, which is well-known as a binary microlensing event discovered in 2016. More observations of *gaia16aye* were needed to follow the progress of the event. Photometric observations were performed at the Moletai Astronomical Observatory with the 1.65 m telescope and Alta U47 CCD camera.

International project **BRITE-Constellation**. Dr. E. Pakštienė, Dr. Š. Mikolaitis. Since 2016.

We observed high resolution spectra of the object Eps Persei, which is one of the BRITE-Constellation targets and needs additional spectroscopic observations in order to derive basic characteristics of the star (temperature, surface gravity, chemical composition), to characterize its binary orbit and support space photometry with the time resolved spectroscopy for identification of pulsational modes and study pulsational line profile variations. We obtained several individual high resolution spectra on 22 March, 3 April, 4 April, and 6 April. Also we observed two time series of high resolution spectra. One of them contained 27 individual spectra, which were observed on 7 January, and another one contained 38 individual spectra observed on 8 January. Observations were carried out at the Moletai Astronomical Observatory with the 1.65 m telescope and high resolution eschelle type spectrograph VUES.

National Institutes of Natural Sciences (NINS, Japan) International research project **"Construction of Atomic Data and Radiative Transfer Simulations toward Identification of Gravitational Wave Sources and the Origin of Heavy Elements",** 2016–2018. Prof. dr. G. Gaigalas.

We perform atomic structure calculations for r-process elements. We confirm that the opacities from bound-bound transitions of open f-shell, Lanthanide elements are higher than those of the other elements over a wide wavelength range.

COST Action TD1308 **„Origins and evolution of life on Earth and in the Universe"** (ORIGINS) (http://www.cost.eu/COST_Actions/tdp/TD1308). Action Chair: Prof. Muriel Gargaud, France) (29 countries). Dr. habil. G. Tautvaišienė. 2014 – 2018.

In a framework of this COST action, an international conference "Early Earth and ExoEarths: origin and evolution of life" was organised in Warsaw, Poland on 3–7 April, 2017. A scientific presentation "Spectroscopic and Photometric Survey of Northern Sky for Exoplanetary Research" was presented by Mikolaitis Š., Tautvaišienė G., Drazdauskas A., Ženovienė R., Pakštienė E., Janulis R., Bagdonas V., and Klebonas L.

COST Action CA11617 **„Chemical Elements as Tracers of the Evolution of the Cosmos"** (ChETEC) (http://www.cost.eu/COST_Actions/ca/ca11617). Action Chair: Dr. Raphael Hirschi, England) (29 countries). Dr. A. Kučinskas, Managing Committee Member, Co-lead of the Working Group 3 (Future Observations). 2017– 2021.

During the first year of this COST action a strong emphasis was put on the organization and initiation of the action activities. In particular, a join work was started on preparing and submitting new observing proposals, due in 2018, as well as on more extended research programs.

Long-term international project **Researchers' Night 2016/2017** (LT-2016). I. Balčiūnienė (VU), Dr. A. Kazlauskas (ITPA). 2016 – 2017.

The main purpose of this project is meetings of scientists with general public. Such meetings took place on the September 29th at the Molėtai Astronomical Observatory and Planetarium of the Institute of Theoretical Physics and Astronomy. It is a Europe-wide public event dedicated to popular science. More than 30 countries and over 300 cities are involved. The Moletai Astronomical Observatory programme included the show „Hinc itur ad astra", given by the Vilnius University theatre drama troupe "Minimum" (director R. Venckus), 12 lectures given by eight lecturers, tours to professional telescopes, stargazing, show of physical experiments. The especially notable event was the online video-tour of CERN and discussion with scientists working there. Almost all staff of the Observatory and several scientists from other departments have met with 400 people visiting the Observatory.

MAIN R&D&I (RESEARCH, DEVELOPMENT AND INOVATION) PARTNERS

Aarhus University (Denmark)

Nicolaus Copernicus Astronomical Center (Poland)

Kiepenheuer Institut fur Sonnenphysik (Germany)

Leibniz-Institut fuer Astrophysik Potsdam (Germany)

Landessternwarte – Zentrum für Astronomie der Universität Heidelberg (Germany)

Observatoire de Paris, CNRS, Université Paris Diderot (France)

Institute of Theoretical Astrophysics, University of Oslo (Norway)

Center for Physical Sciences and Technology (Lithuania)

Main Astronomical Observatory of Academy of Sciences (Ukraine)

National Astronomical Observatory (Japan)

University of Latvia (Latvia)

Vatican Observatory (USA)

Washington University (USA)

Valparaiso University (USA)

Yale University (USA)

National Institute of Standards and Technology (USA).

University of Kentucky, Lexington (USA)

National Institute for Fusion Science (Japan)

Materials Science and Applied Mathematics, Malmö University, Malmö (Sweden)

Chimie Quantique et Photophysique, Université Libre de Bruxelles (Belgium)

Cracow Jagiellonian University (Poland).

University of South Carolina (USA)

Queen's University Brelfast (UK)
Nuclear Physics Center at Lisbon University (Portugal)

Istituto Nazionale Fisica Nuclear, Pisa (Italy)

Institute for Theoretical Physics II, Ruhr University Bochum (Germany)

University of Seville, Seville (Spain)

Ohio University, Athens, Ohio (USA)

National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing (USA)

Triangle Universities Nuclear Laboratory, Durham, North Carolina (USA)

Jagiellonian University, Cracow (Poland)

University of Nebraska-Lincoln, Lincoln, Nebraska (USA)

Seoul National University, Seoul (Korea)

European Organization for Nuclear Research CERN (Switzerland)

Joint Institute for Nuclear Research (Dubna, Russia)

Centre for Theoretical Particle Physics, University of Lisbon, CFTP (Portugal)

National Institute of Standards and Technology (USA)

National Tsing Hua University (Taiwan)

Heriot-Watt University (UK)

ICREA and ICFO (Spain)

Leibniz Universität, Hannover (Germany)

Boston University (USA)

OTHER SCIENTIFIC ACTIVITIES

Dr. K. Černis –

- member of the Lithuanian Astronomical Olympiad Council;
- member of the International Astronomical Union (IAU).

Prof. G. Gaigalas, dr. P. Rynkun, and L. Radžiūtė

member of CompAS (The International collaboration on Computational Atomic Structure) group (http://ddwap.mah.se/tsjoek/compas/)

Dr. V. Gontis –

- member of the association of *Euroscience*, http://www.euroscience.org/

Dr. A. Juodagalvis –

- Contact person for the CMS outreach and communication in Lithuania, representing the Lithuanian Team at CERN CMS experiment (since 2015);
- Chairman of the Committee to Coordinate Vilnius University Collaboration with CERN (since 2016).

Dr. Habil. G. Juzeliūnas –

- associated member of the National Center for Theoretical Sciences at the National Tsing Hua University, Taiwan;
- member of the Institute of Physics (UK);
- Co-Chair of the Scientific organizing committee of the 42^{nd} *National Physics Conference*, Vilnius, Lithuania, October 4 – 16, 2017.

Prof. B. Kaulakys –

- member of the Institute of Physics (UK);
- member of the European Physical Society;
- editorial board member of the Lithuanian Journal of Physics;
- editorial board member of the journal Nonlinear Analysis. Modeling and Control;
- vice-president of the Lithuanian Association of Nonlinear Analysts;
- council member of the Lithuanian Scientific Society;
- member of the Senate of Vilnius University.

Prof. R. Karazija –

- editorial board member of the Lithuanian Journal of Physics;
- member of the Lithuanian Academy of Sciences.

Dr. A. Kynienė –

- president of the Vilnius City Board of the Physics Teachers' Association;
- member of Vilnius City Physics Methodical Board;

- Team leader of Particle physics outreach group at the VU Experimental nuclear and particle physics centre.

Dr. A. Kučinskas –

- member of the Board of Directors of the International journal Astronomy and Astrophysics;
- vicepresident, Lithuanian Astronomical Society;
- member of the International Astronomical Union.

Dr. A. Kupliauskienė –

- head of the board of Association "BASNET Forumas" (http://www.basnetforumas.eu /index.php?option=com_content&view=frontpage&lang=en)
- A substitude member of Lithuania in the board of European Platform of Women Scientists (EPWS).

Dr. Š. Mikolaitis –

- member of the European Astronomical Society.

Dr. D. Narbutis –

- member of the International Astronomical Union (IAU).

Dr. E. Pakštienė –

- member of the International Astronomical Union (IAU).

Dr. J. Sperauskas –

- member of the International Astronomical Union (IAU).

Dr. R. Stonkutė –

- member of the International Astronomical Union (IAU).

Prof. V. Straižys –

- editor-in-chief of the International journal *Baltic Astronomy*;
- member emeritus of the Lithuanian Academy of Sciences;
- member of the working group on stellar classification of the ESA Gaia project;
- member of the International Astronomical Union;
- member of the European Astronomical Society.

Dr. J. Tamulienė –

- management committee member of the Lithuanian Physics Society;
- leader of the Professional Union of Vilnius University.

Dr. Habil. G. Tautvaišienė –

- vicepresident of the International Union of Pure and Applied Physics;
- vicepresident of the Lithuanian Physics Society;
- chair of Astrophysics Commission at the International Union of Pure and Applied Physics;
- member of the International Astronomical Union (IAU);
- founding member of the European Astronomical Society;
- editorial board member of the journal "Baltic Astronomy";
- editor-in-chief of the annual astronomical almanac *Lietuvos dangus* (*Sky of Lithuania*);
- member of the Scientific organizing committee of the international conference *XXIX Texas Symposium on Relativistic Astrophysics*, December 3–8, 2017, Cape Town, South Africa;
- member of the Scientific organizing committee of the international conference "Early Earth and ExoEarths: origin and evolution of life, Warsaw, Poland, 3 – 7 April, 2017;
- member of the Local organizing committee of the European Planetary Science Congress 2017, Riga, Latvia, 17 – 22 September, 2017;
- Co-Chair of the Scientific organizing committee of the 42nd *National Physics Conference*, Vilnius, Lithuania, October 4 – 16, 2017;
- member of the Scientific organizing committee of the international conference "Baltic Applied Astroinformatics and Space Data Processing", August 23–24, 2017, Ventspils, Latvia;
- Chair of the Scientific organizing committee of the international Europlanet Summer School "Space missions: ground-based observations and science communication", July 18–28, 2017, Molėtai, Lithuania.

Prof. Dr. V. Vansevičius –

- member of the International Astronomical Union (IAU).