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A&M DATA - Atmosphere

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Edited by Vladimir A. Srećković, Milan S. Dimitrijević,

Nikola Veselinović and Nikola Cvetanović

A&M DATA

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SCIENTIFIC RATIONALE

Spectroscopy is a powerful tool for the analysis of radiation from different plasmas in astronomy, laboratory, fusion research, atmospheric research and industry. Effective theoretical analysis, synthesis and modelling of stellar spectra as well as the spectra from other plasma sources, depends on atomic data and their sources. In particular, for the modelling of stellar atmospheres and opacity calculations a large amount of atomic data is needed, since we do not know *a priori* the chemical composition of a stellar atmosphere. Consequently, the development of databases with atomic data and astroinformatics is important for stellar spectroscopy.

The Conference is planned as an opportunity to consider above mentioned aspects of spectroscopic research on plenary sessions and then to work on the special mini-projects, which will result in common papers to be published in international astronomical journals after the Conference.

Venue

Fruška Gora (Ceptor, Andrevlje), Serbia

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Analysis of laser induced plasma plume in atmosphere: artificial neural network approach

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Time resolved analysis of spectra of laser initiated electric discharge spark in atmosphere is presented here. Spectral images of optical emission of atmospheric plasma are obtained by a streak camera.

Various machine learning (ML) techniques are used more and more for analysis of LIBS data. The combination of the popular machine learning algorithms (PCA and LDA, unsupervised and supervised techniques, respectively) with LIBS are used to complete rapid and precise classification of different samples (Bellou et al. 2020, Diaz et al. 2019, Pořízka et al. 2018, Yang et al. 2020, Zhang et al. 2020). An artificial neural network (ANN) algorithm is also used for the determination of electron temperature and electron number density in LIBS (Borges et al. 2014, D'Andrea 2015). The advantage of ANNs is in the possibility of reproducing nonlinear relations between the inputs and the output(s).

In our recent work we have combined several machine learning techniques, such as K-nearest neighbors classification together with clustering algorithms in supervised manner which is possible in SOLO software, in order to estimate plasma temperature (Rabasovic et al. 2022). Now, we have advanced research through the ANN and deep learning technique. Namely, large set of measured spectra are used to train the artificial neural network to obtain the estimation of plasma temperature. For machine learning approach to data analysis we use Solo+Mia software package (Version 9.0, Eigenvector Research Inc, USA) (Wise et al. 2006).

References

Bellou,E., Gyftokostas,N., Stefas, D., Odhisea, G.O., Courisa S., 2020, Spectr. Acta Part B: Atom. Spectr, 163, 105476. https://doi.org/10.1016/j.sab.2019.105746

Borges F., Cavalcanti G.H., Gomes G.C., et al., 2014, Appl. Phys. B, 117, 437–444. https://doi.org/10.1007/s00340-014-5852-8

Diaz, D., Molina, A., Hahn, D.W 2019, Appl. Spectrosc. 74 (1), 42–54. https://doi.org/10.1177/0003702819881444

D'Andrea E., Pagnotta S., Grifoni E., et al, 2015, Appl. Phys. B, 118, 353–360. https://doi.org/10.1007/s00340-014-5990-z

Pořízka P., Klusa J., Képeš E., Prochazka D., Hahn D.W., Kaiser J., 2018, Spectr. Acta Part B, 148 (2018) 65–82. https://doi.org/10.1016/j.sab.2018.05.030

Rabasovic M.S., Marinkovic B.P, Sevic D, 2022, Adv. In Space Res…in press... https://doi.org/10.1016/j.asr.2022.04.046

Wise, B.M., Gallagher, N.B., Bro, R., Shaver, J.M., Windig, W., Koch R.S., 2006. Chemometrics tutorial for PLS_Toolbox and Solo. ISBN: 0-9761184-1-6, Eigenvector Research, Inc. USA.

Yang, Y., Hao, X., Zhang. L., Ren, L., 2020, Sensors, 20 (5), 1393. https://doi.org/10.3390/s20051393

Zhang D., Zhang H., Zhao Y., Chen Y., Ke C., Xu T., He Y., 2020, Appl. Spectr. Rev. 57, 89-111. https://doi.org/10.1080/05704928.2020.1843175

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