

ACTIVITIES OF PARTICIPANTS OF THE PROJECT 146001 "INFLUENCE OF COLLISIONAL PROCESSES ON THE ASTROPHYSICAL PLASMA SPECTRA" - 2006-2007

MILAN S. DIMITRIJEVIĆ

Astronomical Observatory, Volgina 7, 11060 Belgrade, Serbia
e-mail: mdimitrijevic@aob.bg.ac.yu

Abstract. The review of activities on the project 146001 "Influence of collisional processes on the astrophysical plasma spectra", supported by the Ministry of Science and Technological Development of Serbia from 1st January 2006 up to 31st December 2007 is given, together with the bibliography of published works.

Investigations made from 1st January 2006 up to 31st December 2007 within the frame of the Project „Influence of collisional processes on the astrophysical plasma spectra concern plasma in astrophysics, laboratory and technology and the corresponding modelling, determination and research of atomic and molecular processes, optical properties and spectra, with a particular accent on the role of collisional processes. The particular attention has been paid to the investigation of spectral line profiles, broadened by collisions with charged particles (Stark broadening), which are important for the diagnostic and modelling of stellar plasma, plasma in laboratory and technological plasma. Semiclassical perturbation and Modified semiempirical methods were used, tested and investigated. Stark broadening parameters, line width and shift, were determined for a large number of lines and obtained results are applied for the investigation of its influence in stellar atmospheres.

Participants of the Project published 10 articles in leading international journals (the number of papers is given between parentheses), namely in: *Astronomy and Astrophysics* (3), *Astrophysical Journal* (2), *Astrophysical Journal Supplement Series* (1), *Monthly Notices of the Royal Astronomical Society* (1), *Spectrochimica Acta B* (1), *Astronomical Journal* (1) and *Publications of the Astronomical Society of Pacific* (1).

In international journals *New Astronomy* (3), *Physica Scripta* (1), *Publications of the Astronomical Society of Japan* (2), *New Astronomy Review* (1) and *Planetary and Space Science* (1), 8 papers are published, and 29 in international journals which are not on SCI list and in books of international publishers.

Other results are: Invited lectures on international conferences published in books of international publishers (9), and other proceedings (7), articles in national journals and books (6), contributions in proceedings of international conferences (17), contributions in proceedings of national conferences (9), abstracts of invited lectures on international conferences (5), abstracts of presentations on international conferences (31), abstracts of invited lectures on national conferences (2), and abstracts of presentations on national conferences (13).

In total, Project participants published 146 bibliographic items, and 116 are related to the Project while 30 are not.

Participants of the Project organized four Conferences and a Summer School, contributing in such a way to the development of scientific collaboration. They are:

1. «DEVELOPMENT OF ASTRONOMY AMONG SERBS IV», Belgrade, 22 – 26. April 2006, M. S. Dimitrijević President of Scientific Committee, member M. Dačić, members of Local Organizing Committee, M. S. Dimitrijević, M. Dačić.
2. 5th BULGARIAN-SERBIAN CONFERENCE ON ASTRONOMY AND SPACE SCIENCE, Sofia, 9 – 12. May, 2006, M. S. Dimitrijević Co-president of Scientific Committee.
3. VI SERBIAN – BELARUSSIAN SYMPOSIUM ON PHYSICS AND DIAGNOSTICS OF LABORATORY AND ASTROPHYSICAL PLASMAS (PDP-VI'2006), Belgrade, 22 – 25. August 2006, M. S. Dimitrijević Co-president of Scientific Committee, members of Local Organizing Committee, N. Milovanović, M. Dačić.
4. 6th SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS, Sremski Karlovci, 11 – 15. June 2007, M. S. Dimitrijević Co-president of Scientific Committee, member D. Jevremović, N. Milovanović, Secretarz of Local Organizing Committee, members M. S. Dimitrijević, M. Dačić, A. Kovačević, Z. Simić.
5. THE FIRST SUMMER SCHOOL IN ASTRONOMY AND GEOPHYSICS, Belgrade, 6 - 10. August 2007, M. S. Dimitrijević Co-president of Scientific Organizing Committee, Secretary A. Kovačević.

During 2006, on the Ptroject were six, and in 2007 seven researchers, six from Astronomical Observatory and Andjelka Kovačević from Mathematical Faculty. The leader of the Project within the considered period was Milan S. Dimitrijević, and the participants are:

1. *Miodrag Dačić*, (1946) 2006 and 2007 with 20 research months (rm)
2. *Milan S. Dimitrijević*, (1947) 2006 and 2007 with 24 rm
3. *Darko Jevremović*, (1968) 2006 and 2007 with 18 rm
4. *Andjelka Kovačević*, (1972, MF) 2007 with 8 rm
5. *Nenad Milovanović*, (1979) 2006 and 2007 with 24 rm

6. **Zoran Simić**, (1967) 2006 and 2007 with 24 rm
7. **Dragana Tankosić**, (1968) 2006 and 2007 with 15 rm



Figure 1: Milan S. Dimitrijević.



Figure 2: Miodrag Dačić.

During two years, seven participants were engaged for 133 research months, i.e. 11.1 years. The average age was around 44 years (or year of birth 1963.9).

The Ministry of Science of Serbia, accepted the project in accordance with the call for projects announced in 2005, and the financial structure of this project within the considered period is given below.

2007.	
• 1. Salaries for the researchers	5 426 944 SD
• 3. Expenses of the institution	1 780 741 SD
• 2. Expenses of the Project	872 764 SD
SUB-TOTAL	8 989 449 SD
2006.	
• 1. Salaries for the researchers	3.965.673 SD
• 2. Expenses of the institution	1.801.954 SD
• 3. Expenses of the Project	885.982 SD
SUB-TOTAL	6.653.608 SD

TOTAL 2006 - 2007.	14 734 057 SD
(~185 000 EUR – 1 EUR = 80 SD)	



Figure 3: Andjelka Kovačević.



Figure 4: Dragana Tankosić.



Figure 5: Darko Jevremović.



Figure 6: Nenad Milovanović.



Figure 7: Zoran Simić.

Decisions on expenses for institution were made by director, while decisions concerning expenses for travels, materials and equipments were made on the project level. They were spent for travelling, international collaboration, small equipments, supplies and material.

We wish to underline that results of this project contribute to the presence of Serbia in leading international journals and its involvement to the collective efforts of the whole humanity to develop continuously fundamental sciences as the basis for further progress.

In 2006-2007, investigations of the influence of collisional processes on the astrophysical plasma spectra were performed in several directions. The influence of Stark broadening on the spectra of chemically peculiar A-type stars, white dwarfs and M dwarfs was investigated. Moreover, Stark broadening parameters, not known up to now, for a number of astrophysically interesting spectral lines, were determined. Our objective is to enable to check the theoretical and laboratory Stark broadening data by stellar spectra observations. We demonstrated this for the first time in Dimitrijević et al. *Astron. Astrophys.* 469, 681, 2007, where on the basis of observed ionized chromium lines in stellar spectra, we analyzed the reliability of theoretical and experimental results for Stark broadening. Also, synthesizing hydrogen line spectra in M red dwarfs, using the PHOENIX code, we demonstrated how by observations of hydrogen line Stark broadening in stellar spectra one can test the theory for the influence of particular collisional processes on the modelling of stellar spectra (Mihajlov et al. *Astron. Astrophys.* 471, 671, 2007). The influence of the photodissociative and radiative collisional processes, not taken into account up to now, on the opacity of solar atmospheres was also considered (Mihajlov et al. *Astron. Astrophys.* 469, 749, 2007), a new method for the gas temperature determination using van der Waals broadening of spectral lines was developed (Yubero et al., *Spectrochimica Acta B*, 62, 169, 2007) and, using together several computer codes, it was demonstrated, on the example of Ne V, how one can determine Stark broadening parameters *ab initio* (Hamdi et al., *Astrophys. J. Suppl.*, 170, 243, 2007). These are only the most important results and the others could be seen from the bibliography of published papers, given below.

M. S. Dimitrijević was also co-mentor to Magdalena Christova, which on 18 December 2007 defended in Sofia his PhD Thesis.

Within the frame of the Project, was worked on the development of the database for Stark broadening on Astronomical Observatory and Paris observatory in Meudon.

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