АКТИВНОСТИ САРАДНИКА ПРОЈЕКТА “УТИЦАЈ СУДАРНИХ ПРОЦЕСА НА СПЕКТРЕ АСТРОФИЗИЧКЕ ПЛАЗМЕ”

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Астрономска опсерваторија
Београд

ПРОЈЕКАТ 176002

Истраживање утицаја атомски сударних процеса на спектре астрофизичке, односно гео-космичке плазме у 2015/16 години одвија се у правцима:

1. Експериментално истраживање простирања VLF таласа у таласоводу Земља-јоносфера континуираним мерењем амплитуде и фаза у опсегу 10-30kHz уз AbsPAL и AWESOME систем, чиме се пратио утицај Сунчеве активности и атмоферских електричних пражњења у овом таласоводу.

2. Утицај Штарковог ширења на спектре топлих звезда класе А и Б, белих патуљака и новооткривене класе угљоводоничних патуљака, при чему су одређивани параметри ове врсте ширења, а резултати улазе у FP7 пројекат VAMDC и базу података STARK-B.

3. Утицај нееластичних процеса на атом-Ридбергов атом сударима на кинетику слабо јонизоване плазме Сунца и белих патуљака.

4. Истраживана је интеракција између високо енергетских електрона са Сунца и међупланетарне плазме кроз коју се простиру по линијама сила Сунчевог магнетног поља, уз помоћ посматрања са сателита “Wind” и “STEREO”.

Истраживачи ангажовани у години за коју се подноси извештај

Р.Б.	ЈМБГ	Име	С	Презиме	Титула	Звање	ДАТУМ стицања звања (дд/мм/гггг)	Шифра НИО	Тренутни статус	Тренутни БИМ	БИМ за наредну годину	Остаје на пројекту	Категорија (стање)	E - mail истраживача	Напомена
1	2408947710415	Милан		Димитријевић		12-Научни саветник		200002	Да	0	0	Да	A1	mdimitrijevic@aob.rs	
2	1605968301805	Дарко		Јевремовић		12-Научни саветник		200002	Да	3	3	Да	A1	darko@aob.rs	
3	2605946710020	Миодраг		Дачић		11-Виши научни сарадник		200002	Да	0	0	Да	A1	mdacic@aob.rs	
4	1407972710373	Ненад		Миловановић		13-Стручни сарадник		200002	Да	0	0	Да	A2	nmilovanovic@aob.bg.ac.rs	
5	1905968788716	Драгана		Танкосић		10-Научни сарадник		200227	Да	6	6	Да	A2	dtankosic@yahoo.com	
6	0503967710123	Зоран		Симић		11-Виши научни сарадник		200002	Да	10	10	Да	A1	zsimic@aob.rs	
7	3003972885029	Анђелка		Ковачевић		3-Доцент		200104	Да	7	7	Да	A1	andjelka@matf.bg.ac.rs	
8	2308981175044	Јелена		Ковачевић-Дојчиновић		10-Научни сарадник		200002	Да	1	1	Да	A1	jkovacevic@aob.rs	
9	2208960715540	Соња		Видојевић		2-Асистент		200252	Да	0	0	Да	A2	sonja.vidojevic@yahoo.com	Пензионисана 2016
10	2010941060016	Анатолиј		Михајлов		12-Научни саветник		200024	Да	0	0	Да	A1	promeni@me.rs	Преминуо 2016
11	0303959710042	Љубинко		Игњатовић		12-Научни саветник		200024	Да	12	12	Да	A1	ljuba@ipb.ac.rs	
12	0103972710052	Владимир		Срећковић		11-Виши научни сарадник		200024	Да	5	5	Да	A3	vlada@ipb.ac.rs	
13	1308977805102	Александра		Нина		10-Научни сарадник		200024	Да	5	5	Да	A4	sandrast@ipb.ac.rs	
14	0000000DanEma	Emanuel		Danezis		20-Странац		200002	Не	0	0	Не	A1	edanezis@phys.uoa.gr	
15	0000000AntAnt	Antonios		Antoniou		20-Странац		200002	Не	0	0	Не	A1	ananton@phys.uoa.gr	
16	0000000SahSyl	Sylvie		Sahal-Brechot		20-Странац		200002	Не	0	0	Не	A1	sylvie.sahal-brechot@obspm.fr	
17	0000000BenNeb	Nebil		Ben Nessib		20-Странац		200002	Не	0	0	Не	A1	nebil.bennesib@planet.tn	
18	0000000HriMag	Магдалена		Христова		20-Странац		200002	Не	0	0	Не	A1	mchristo@tu-sofia.bg	
19	0000000CalMar	Maria Dolores		Calzada		20-Странац		200002	Не	0	0	Не	A1	falcazal@uco.es	
20	0000000RjaTat	Татјана		Рјабчикова		20-Странац		200002	Да	0	0	Да	A1	ryabchic@inasan.ru	
21	0000000FraSie	Siegfrid		Franck		20-Странац		200104	Не	0	0	Не	A1	promeni@me.rs	Преминуо 2011
22	0000000MakMil	Милан		Максимовић		20-Странац		200227	Да	0	0	Да	A1	milan.maksimovic@obspm.fr	
23	2905959102384	Јово		Врањеш		20-Странац		200002	Да	0	0	Да	A1	jvranjes@yahoo.com	
24	0105980800101	Душан		Марчета		3-Доцент		200104	Да	8	8	Да	A4	dmarceta@matf.bg.ac.rs	
25	0304984715004	Сања		Животић		9-Истраживач сарадник		200104	Не	0	0	Не	A4	promeni@me.rs	Напустила пројекат 2012
26	0612974715371	Бранкица		Шурлан		10-Научни сарадник		200029	Да	12	12	Да	A5	surlanbrankica@gmail.com	
27	2211988790050	Михаило		Мартиновић		9-Истраживач сарадник		200227	Да	12	12	Да	A4	Mihailo.Martinovic@obspm.fr	
28	0403972710390	Ненад		Сакан		10-Научни сарадник		200024	Да	12	12	Да	A3	nsakan972@gmail.com	

Планиран укупан ДМТ: 2610000дин

Репроматеријал 200000

Ситна опрема и инвентар: 750000

Путни трошкови: 970000

Услуге трећим лицима: 550000

Трошкови на промоцију и популаризацију: 140000

Процентуална расподела:

АОВ 84%

IF 16%

200002 АОВ

200024 IF

200029 MI

200104 MF

200227 IHIS

200252 DUNP

Пример 2015 година.

Р.Б.	НИО	Укупан ДМТ(II)	Репроматеријал	Ситна опрема и инвентар	Путни трошкови	Услуге трећим лицима	Заштита интелектуалне својине (ЗИС)	Трошкови за промоцију и популаризацију остварених резултата	Неутрошена средства	Напомена
1	200002 - Астрономска опсерваторија	545244.21	21516.00	28476.00	285313.31	209938.90	0.00	0.00	0.00	
2	200024 - Универзитет у Београду, Институт за физику	110173.07	0.00	24356.00	56917.07	28900.00	0.00	0.00	0.00	
3	200029 - Математички институт САНУ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4	200104 - Универзитет у Београду, Математички факултет	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5	200227 - IHIS Techno-Experts d.o.o.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6	200252 - Државни универзитет у Новом Пазару	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

Резултати 2015 и 2016 година.

Међународни часописи (М10 и М20):

М13-2

М21-12

М22-3

М23-15

Зборници са међународних научних скупова (М30):

М31-1

М32-12

М33-26

М34-36

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY
MNRAS **460,** 1658–1663 (2016) doi:10.1093/mnras/stw1023
Advance Access publication 2016 May 1

Stark broadening of B IV spectral lines

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Accepted 2016 April 28. Received 2016 April 28; in original form 2015 December 9

ABSTRACT

Stark broadening parameters for 157 multiplets of helium-like boron (B IV) have been calculated using the impact semiclassical perturbation formalism. Obtained results have been used to investigate the regularities within spectral series. An example of the influence of Stark broadening on B IV lines in DO white dwarfs is given.

Key words: atomic data – atomic processes – line: formation.

1 INTRODUCTION

The study presents Stark broadening parameters (widths and shifts) of B IV spectral lines calculated using the impact semiclassical perturbation formalism (Sahal-Bréchot 1969a,b). B IV is a helium-like ion and such ions are rather commonly used for the diagnosis (Kolk, König & Kunze 1986) of laboratory (Doyle & Schwob 1982; Boiko et al. 1983; Källne, Källne & Pradhan 1983) and astrophysical plasmas (McKenzie & Landecker 1982).

In astrophysics, Stark broadening data for various atomic and ionic lines (since we do not know a priori the chemical composition of a star) are of particular interest, especially for white dwarfs, where this line-broadening mechanism is usually the principal one (Popović, Dimitrijević & Tankosić 1999a; Tankosić, Popović & Dimitrijević 2003; Milovanović et al. 2004; Simić et al. 2006; Hamdi et al. 2008; Dimitrijević et al. 2011; Dufour et al. 2011; Larbi-Terzi et al. 2012; Simić, Dimitrijević & Sahal-Bréchot 2013; Simić, Dimitrijević & Popović 2014). This broadening mechanism may be of interest and for the main-sequence stars, especially for A type and late B type (Lanz, Dimitrijević & Artru 1988; Popović, Dimitrijević & Ryabchikova 1999b; Popović et al. 1999a,2001a; Popović, Milovanović & Dimitrijević 2001b; Dimitrijević et al. 2003b,a, 2004, 2005; Tankosić et al. 2003; Milovanović et al. 2004; Simić et al. 2005a,b, 2013, 2014; Simić, Dimitrijević & Kovačević 2009).

We note as well the increasing astrophysical importance of Stark broadening data for various atoms and ions of trace elements, without an astrophysical meaning before the development of satellite-borne telescopes, which now are providing high-resolution spectra of earlier inaccessible quality. Well-resolved line profiles for many white dwarfs, where Stark broadening is important, have been and will be provided, for example, by the Space Telescope Imaging Spectrograph, Cosmic Origins Spectrograph and Goddard High Resolution Spectrograph (GHRS), *Far Ultraviolet Spectroscopy Explorer*, the *International Ultraviolet Explorer*, and others.

Data on boron lines, including Stark broadening, are of interest in astrophysics, but also for example for laboratory (Blagojević et al. 1999), fusion (Iglesias et al. 1998), and laser-produced (Nicolosi et al. 1978) plasma investigations, as well as for laser research and development (Wang et al. 1992). In astrophysics, the light elements lithium, beryllium, and boron are of great interest for two sets of reasons, which might be categorized as cosmological and related to stellar structure (Duncan et al. 1998). A general trend in nature is that the abundance of the elements versus the mass number draws a globally decreasing curve (Vangioni-Flam & Cassé 1999; Vangioni-Flam, Cassé & Audouze 2000). However, the rare and fragile light nuclei, lithium, beryllium, and boron are not generated in the normal course of stellar nucleosynthesis (except ^{7}Li, in the galactic disc) and are, in fact, destroyed in stellar interiors. The standard big bang nucleosynthesis theory is not effective to explain the generation of ^{6}Li, ^{9}Be, ^{10}B, and ^{11}B (Delbourgo-Salvador & Vangioni-Flam 1993; Schramm 1993; Thomas et al. 1993), what is reflected in the low abundance of these simple species. Consequently, the origin and evolution of boron are of particular interest and the corresponding Stark broadening data are needed (Tankosić et al. 2003).

The importance of light element abundance for the giant-branch evolution is underlined in Duncan et al. (1998). The stellar structure interest steems from the fact that Li, Be, and B undergo nuclear reactions at relatively low temperatures, approximately 2.5, 3.5, and 5×10^6 K at densities similar to those in the Sun. Since these

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IOP Conf. Series: Journal of Physics: Conf. Series **810** (2017) 012058 doi:10.1088/1742-6596/810/1/012058

Influence of Rydberg atom-atom collisional and (n-n')-mixing processes on optical properties of astrophysical and low-temperature laboratory plasmas

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Abstract. Here, we will consider the influence of the (n-n')-mixing processes during atom Rydberg-atom collision processes on the intensity of chemi-ionization process. We will take into account H(1s) + H*(n) and He(1s^2) + He*(n,l) collisional systems, where the principal quantum number $n >> 1$. The corresponding calculations of the chemi-ionization rate coefficients are performed for the temperature region characteristic for the solar and DB white dwarf atmosphere.

1. Introduction and the theoretical remarks

The processes with participation of the Rydberg atoms are still important in the investigation of different stellar atmospheres as well as in the laboratory experiments [1, 2, 3, 4, 5, 6]. The main aim of this paper is the consideration of two kinds of atomic collision processes involving Rydberg atoms which simultaneously occur in the stellar atmospheres and the influence of one on the other. We will analyze the processes of chemi-ionization: in the hydrogen case

$$\mathrm{H}^*(n,l) + \mathrm{H}(1s) \to \mathrm{H}(1s) + \mathrm{H}^+ + \vec{e} \tag{1a}$$

$$\mathrm{H}^*(n,l) + \mathrm{H}(1s) \to \mathrm{H}_2^+ + \vec{e} \tag{1b}$$

and in the helium case

$$\mathrm{He}^*(n,l) + \mathrm{He}(1s^2) \to \mathrm{He}(1s^2) + \mathrm{He}^+(1s) + \vec{e} \tag{2a}$$

$$\mathrm{He}^*(n,l) + \mathrm{He}(1s^2) \to \mathrm{He}_2^+ + \vec{e} \tag{2b}$$

where the principal quantum number $n >> 1$, and the orbital quantum number l changes in the interval from 0 to $n-1$. Here, we also study the (n-n)-mixing processes:

$$\mathrm{H}^*(n,l) + \mathrm{H}(1s) \to \mathrm{H}(1s) + \mathrm{H}^*(n',l'), \tag{3}$$

Број доктораната за период 2011-2015. година: 7

Број истраживача који су докторирали у периоду 2011-2015.: 6

Драгана Танкосић

Јелена Ковачевић

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Скупови

2016 XSBAC Београд

2015 10thSCSLSA Сребрно језеро

2016-2017

Билатерална сарадња са Француском

Evidencioni broj projekta	Naslov projekta	Srpski predlagač	Srpska institucija	Francuski predlagač	Francuska institucija
451-03-39/2016/09/15	Usavršavanje tačnosti spektroskopsko dijagnostičkih modela za astrofizičku i magnetno fuzionu plazmu	Zoran Simić	Astronomska opservatorija, Beograd	Joël Rosato	Laboratorija PIIM, UMR 7345 Aix-Marseille Université /CNRS

Eur. Phys. J. D (2017) 71: 68
DOI: 10.1140/epjd/e2017-70737-2

THE EUROPEAN PHYSICAL JOURNAL D

Regular Article

Line shapes in turbulent plasmas*

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Received 25 November 2016 / Received in final form 7 February 2017
Published online 21 March 2017 –

Abstract. The fluctuations and oscillations observed in turbulent plasmas may affect the line shapes emitted by atoms and ions. We investigate several plasma conditions for which a spectroscopic signature of plasma turbulence can be observed. Starting from the simple model of microturbulence for Doppler profile, we examine how information on turbulent fluctuations is obtained in astrophysics and magnetic fusion plasmas. We recall the potential of a formalism which expresses the measured line shape in function of the probability density function of the fluctuating plasma parameters. New calculations of hydrogen dipole autocorrelation functions and line shapes are presented for plasmas affected by strong Langmuir turbulence and nonlinear wave collapse. We propose a model using a sequence of envelope solitons for the electric field created by the wave packets and felt by the emitters, and show that the line shape may be dominated by the effect of strong Langmuir turbulence.

1 Introduction

In a stable (non-turbulent) plasma, the random microscopic fluctuations result in reproducible observable effects, such as line shapes. In an unstable plasma, further microscopic fluctuations and oscillations are possible and may also result in observable effects or "signatures", for instance on line shapes with the appearance of satellites [1]. Plasma turbulence is a state of the plasma for which instabilities have permitted a significant development of fluctuations and oscillations. Many different instabilities exist in a plasma, each one leading to a specific turbulent process and requiring a particular approach. In this work we will review only turbulent plasmas which may be investigated by observing the line shapes emitted by atoms and ions in the plasma. If line broadening is dominated by Doppler effect, the line shape reflects the velocity distribution of the emitters along the line of sight. In a plasma at equilibrium, it is then possible to obtain the temperature of the emitters. If nonthermal movements take place on the line of sight, the line shape may no longer correspond to a Gaussian velocity distribution at the emitter temperature. The study of line shapes may then provide valuable information on the nature of turbulence, and this has been used in astrophysical and laboratory plasmas. In denser plasmas, the broadening of line shapes is often dominated by Stark effect. Turbulent fluctuations on the line of sight can modify the measured Stark profile, which can be expressed in function of statistical properties of the fluctuating plasma parameters. Another cause of Stark profile changes is the presence of turbulent waves in the plasma. Such waves can also modify different parts of the line shape. We will present a line shape model suited to the case of nonlinear wave packet collapse, a phenomenon appearing in plasmas submitted to an external source of energy, such as a beam of charged particles. The nonlinear coupling of Langmuir, ion sound and electromagnetic waves changes the structural and radiative properties of the plasma. Wave packets concentrate in regions of low densities, and evolve to shorter scales and higher intensities. We have proposed a line shape model for calculating the effect of wave packet collapse on a hydrogen emitter.

2 Doppler broadening

Doppler broadening results from the Doppler frequency shift $\Delta\nu = \nu_0 v/c$ observed in a reference frame where the emitter moves with a velocity v along the line of sight, and ν_0 is the emission frequency in the emitter frame of reference. This expression is valid for velocities v much smaller than the light velocity c (non-relativistic Doppler effect). If one observes a set of atoms moving in a plasma, the Doppler profile reflects the distribution of velocity projections along the line of sight. For a thermal velocity

* Contribution to the Topical Issue "Physics of Ionized Gases (SPIG 2016)", edited by Goran Poparic, Bratislav Obradovic, Dragana Maric and Aleksandar Milosavljevic.

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ЗАЈЕДНИЧКИ ПРОЈЕКТИ

СРПСКЕ АКАДЕМИЈЕ НАУКА И УМЕТНОСТИ И БУГАРСКЕ АКАДЕМИЈЕ НАУКА

ЗА ПЕРИОД 2017-2019. ГОДИНЕ

6.

РАЗВОЈ И ПРИМЕНА АСТРОНОМСКИХ БАЗА ПОДАТАКА. ИНТЕРКОНЕКЦИЈА БУГАРСКОГ И СРПСКОГ РАДА НА АСТРОНОМСКИМ ЦЕНТРИМА ЗА ПОДАТКЕ

Астрономска опсерваторија

руководилац: др Зоран Симић

Институт за астрономију са Националном астрономском опсерваторијом БАН

руководилац: др Момчил Дечев

Хвала на пажњи!