Short talk

SOLUTION OF NLTE LINE TRANSFER PROBLEM BY USE OF A FORTH-AND-BACK IMPLICIT Λ ITERATION

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Here we present the basic idea and the properties of a very fast convergent iterative method to solve NLTE line transfer problem. Forth-and-back implicit Λ-iteration dramatically accelerates the convergence of the classical Λ iteration (while retaining its straightforwardness) by use of forth-and-back approach together with an implicit representation of the source function in the computation of the radiation field intensities. The fact that no matrix operation is required and that the memory storage grows only linearly with the dimension of the problem makes this method very promising for more complicated radiative transfer problems.

Short talk

KINEMATICS AND VARIABILITY OF III Zw 2 BROAD LINE EMISSION REGION

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In order to study emission line profiles of Lyα, Hβ, Hα, and Mg II λ2798 lines of the Seyfert 1 galaxy III Zw 2, the two-component model of broad-line region (BLR) has been proposed. The proposed two-component model, consisting of an inner Keplerian relativistic disk and an outer structure surrounding the disk, could be fitted well into the emission profiles. The fitting results of these four broad emission lines (BELs) came out higly consistent in both the inner and outer component parameters. Adopting a mass of $\sim$2$\times$108Msolar for the central object, we found that the outer radius of the disk is approximately equal for the four considered lines ($\sim$0.01 pc), and the results for the inner radius of the disk are: 0.0018 pc for Lyα, 0.0027 pc for Mg II, and 0.0038 pc for the Balmer lines. Also, the narrow [O III] lines, indicated existance of at least two kinematicaly different emission-line regions. Flux variations of Hβ, with respect to the [O III] lines, have been also presented here, using long-term Hβ observations (1972-1990, 1998).

Short talk

MULTI-WAVELENGTH SURVEYS OF OBSCURED AGN

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Several key goals require measuring the number of all AGN in the Universe, and the evolution of the ratio of obscured to unobscured AGN with redshift. This reflects the structure of AGN and thus the development in the heart of all galaxies. Hard X-rays can penetrate most obscuring dust columns to reveal the AGN that remains hidden in all other wavelengths. Mid-IR surveys probe the thermal dust emission, that is, the continuum light from the central source after it is reprocessed by dust, and this emission dominates the bolometric luminosities of dusty high-redshift galaxies. Thus, combining deep mid-IR and hard X-ray surveys can provide us with accurate demographics of AGN especially at high redshifts. Multi-wavelength surveys aim to address these science goals by exploiting the unprecedented combination of great observatories such as HST, Chandra and SIRTF to survey the distant universe to the faintest flux limits across the broadest range of wavelengths. I will present and discuss some of the results coming from multi-wavelength surveys placing particular focus on the systematic study of obscured AGN.

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Program and Abstracts

Short talk

STARK BROADENING OF Ar I SPECTRAL LINES EMITTED IN SURFACE WAVE SUSTAINED DISCHARGES

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The Stark parameters (the widths and shift) of six Ar I spectral lines in pure argon: 522.1, 549.6, 603.2, 518.8, 560.7 nm ($nd \rightarrow 4p$, for $n = 7 \div 5$) and 696.5 nm ($4p' \rightarrow 4s$) have been calculated within the semi-classical perturbation approach [1-3].

Surface wave's discharges (SWDs) have been successfully employed in various fields of science and technology, including materials processing, elemental analysis, abatement of harmful gases, and more recently, sterilization of medical devices. Operating at atmospheric pressure we have used emission spectroscopy to determine the electron density of SWDs from the Stark broadening of the emitted argon lines [4].

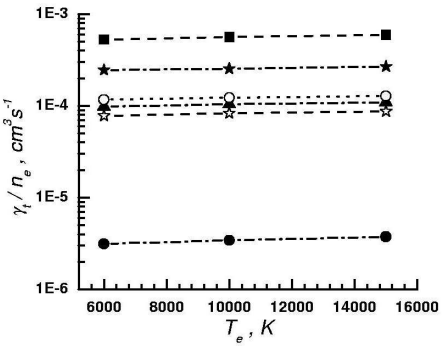

Fig. 1. *The ratio of the total width to the electron density ($n_e = 10^{14} cm^{-3}$) as a function of the electron temperature T_e for the studied Ar I lines (■ 522.1, * 549.6, ○518.6, ▲603.2, *560.7, ●696.6 nm)*

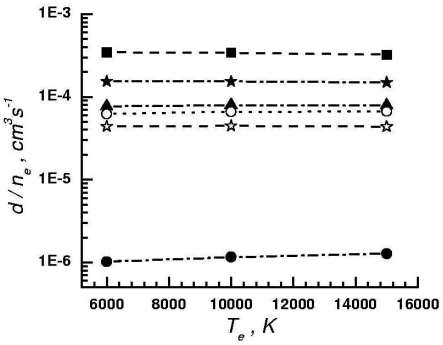

Fig. 2. *The ratio of the shift to the electron density ($n_e = 10^{14} cm^{-3}$) as a function of the electron temperature T_e for the studied Ar I lines (■ 522.1, * 549.6, ▲518.6, ○ 603.2, *560.7, ●696.6 nm)*

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Program and Abstracts

Short talk

ELECTRON IMPACT BROADENING OF MULTICHARGED NEON SPECTRAL LINES

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Stellar and laboratory plasma diagnostic, atomic abundances, opacity calculations, all have led to a need for knowledge about Stark broadening of multicharged ion spectral lines. Sophisticated quantum-mechanical and semiclassical methods (Griem 1974) exist, but they often require a considerable labor even for the evaluation of a single line width. Moreover, when quick estimate is needed, the approximate approaches may be very useful.

One such approximate method is the modified (Dimitrijević and Konjević 1980, 1981) semi-empirical (Griem 1968) formula suitable for singly as well as for multiply charged ion lines, based on the Gaunt factor approximation for inelastic cross sections (Griem 1968). Since the Gaunt factor is proportional to the collision strength, it is of interest to use the collision strength data in the modified semi-empirical formula (Dimitrijević and Konjević 1980) in order to obtain more accurate results.

In this work, instead of the semi-empirical Gaunt factor used in Dimitrijević and Konjević (1980, 1981), more accurate electron impact excitation collision strengths, obtained in the distorted wave approximation in LS coupling, were used. We note also that we take into account the elastic collision contribution to the width by calculating the collision strengths at the threshold energy and extrapolating them below the threshold as in Griem (1968) and, Dimitrijević and Konjević (1980). It has been shown that the elastic contribution to the line width becomes less important with the increase in temperature (Ralchenko et al. 1999).

We have applied this method to the calculation of Stark line widths of two ions, Ne VII and Ne VIII. The comparison with experiments and other theoretical approaches indicates that this method can be used successfully for Stark line width calculations.

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Program and Abstracts

Short talk

MOLECULAR LINE WIDTHS AT STELLAR ATMOSPHERE CONDITIONS

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Molecules are the dominant opacity source in the atmospheres of cool stars, brown dwarfs and planets. As with rapidly decreasing electron pressure at the temperatures of the lowest-mass stars almost no true continuum opacity sources remain, the pseudo-continuum of molecular bands obtains a decisive impact on radiative transfer, and thus thermal structure of the atmosphere. To correctly include molecular opacities in stellar atmosphere calculations, therefore both complete and reasonably accurate lists of line strengths and positions, and correct treatment of line broadening is required. Clearly the classical recipes for calculating Van der Waals broadening e.g. by Unsöld, and their extension to non-hydrogenic atoms, can at best give a crude estimate of molecular interactions. For a realistic treatment of collisional damping therefore measured widths or more sophisticated theoretical broadening constants of molecular lines are required.

In this contribution, an overview of the experimental and theoretical status of line widths for the most important species in ultracool atmospheres, H_2O, CH_4, CO and NH_3, is given. The main difficulty in finding realistic line widths for brown dwarf or stellar models is the paucity of measurements both for the temperature conditions, and for collisions with the dominant perturber in these atmospheres, H_2. Also, theoretical models still struggle to explain observed variations of the width with rotational and vibratonal quantum numbers. The effect of the uncertainty in the resulting Voigt profile widths is studied in model atmospheres computed with the `PHOENIX` code.

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Program and Abstracts

Short talk

THE STRUCTURE OF THE BLR AND NLR IN AGN Mrk 817

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Mrk 817 is a Seyfert 1 galaxy that shows very stratified line emission region. Emission lines of the galaxy, both Narrow (NELs) and Broad Emission Lines (BELs), are very complex and present evidence of the stratified NLR and BLR, indicating different kinematical properties in different part of the BLR and NLR.

Here we present a study of the spectra of Mrk 817 using four sets of spectroscopic observation in order to investigate the emission line region. We found that:

(i) The BLR is kinematically stratified and consists of at least two components - Very Broad Line Region (VBLR) with $V \sim 5000$ km/s and Intermediate Line Region (ILR) with $V \sim 1000$ km/s. We apply the two-component model, where one component is a disk or disk-like region and another one is a spherical emission region with isotropic velocity distribution. The model can well fit the broad line profiles, indicating that there is a disk (or disk-like) emission;

(ii) The NLR also show a complex structure, and we can clearly see at least two NLR regions: a) the NLR1, which has an internal random velocity of 510 km s^{-1}, and relative approaching velocity of -300 km s^{-1} with respect to the systemic redshift of the observed galaxy; and b) the NLR2 which has an internal random velocity of 150 km s^{-1}, and a redshift equal to the systemic one of the corresponding object.

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Program and Abstracts

Short talk

^{6}Li IN THE ATMOSPHERES OF ACTIVE COOL STARS

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^{6}Li enhancement has been shown for energetic solar events, one chromospherically active binary, and several dwarf halo stars. We present high resolution VLT UVES observations of the active dwarfs GJ 117, EUVE J1145−53.5 and GJ182.

Our analysis of high resolution observations includes detailed modeling of theline formation in the 6808 Åregion using the general stellar atmosphere code PHOENIX. We examine the contribution of other lines in the Li profile including Ti I lines which were proposed as an alternative explanation for the ^{6}Li enhancement.

Our principal results are:

i) detection of ^6Li on GJ117 with $\frac{^6Li}{^7Li} = 0.030 \pm 0.007$

ii) detection of ^6Li on dK2e star EUVE J1145−53.5 with $\frac{^6Li}{^7Li} = 0.10 \pm 0.01$,

iii) constraint of the ratio $\frac{^6Li}{^7Li}$ to be ≤ 0.03 for dM0 GJ 182.

We discuss the possibility for ^{6}Li production by spallation and find it to be consistent with the activity of these objects.

Short talk

MICROLENSING EFFECT ON Fe Kα LINE AND X-RAY CONTINUUM IN THE CASE OF THREE GRAVITATIONALLY LENSED QUASARS: MG J0414+0534, QSO 2237+0305 AND H1413+117

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The observed enhancements of Fe Kα line in three gravitationally lensed QSOs: MG J0414+0534, QSO 2237+0305 and H1413+117 is interpreted in terms of microlensing, even if an equivalent X-ray continuum amplification is not observed. To understand these observations we have studied the effects of microlensing on the quasar spectra produced by the crossing of a straight fold caustic across a standard relativistic accretion disk. More realistic case of amplification by a caustic magnification pattern has been studied, also. To describe the disk emission we used a ray tracing method considering both metrics, Schwarzschild and Kerr. Our results show that Fe Kα line is probably emitted from the innermost part of the accretion disk, while the continuum is emitted from some larger region.

Short talk

FRACTIONAL OSCILLATOR AND ANOMALOUS BROWNIAN MOTION IN THE THEORY OF SPECTRAL LINE BROADENING AND SHIFT

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In the paper the fractional oscillator model for the motion of radiating particles in a perturbed gas is suggested. The connection between the fractional oscillator model and anomalous Brownian motion in the Doppler regime is considered. The general formula for the distribution function of the radiating particles in the fractional oscillator model and a new correlation function in the impact approximation are derived. It is shown that the self-similar collision mechanism in the Doppler regime leads to the additional spectral line narrowing and shift. Kinetic equations reconstruction scheme on experimental data is developed on the basis of higher order statistics.

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Program and Abstracts

Short talk

HINSA AS A TOOL FOR STUDYING DARK CLOUDS AND STAR FORMATION

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Traditionally it has been difficult to obtain estimates of the HI content of molecular clouds due to the sheer complexity of the galactic background HI line. However, with the use of the recently discovered HINSA (HI Narrow Self-Absorption) features we are for the first time able to make direct measurements of the HI column density in cold molecular clouds with high extinction. This allows us to study a variety of properties in these clouds including the molecular to atomic hydrogen ratio. Measurements and understanding of this ratio can give us estimates of the chemical ages of these clouds, in turn providing us with constraints on star formation. More specifically we are able to place some constraints on the timescale over which a molecular cloud collapses from a diffuse ($A_v < 1$) to a compact star- forming state. Such constraints would have considerable impact on several disputed areas of star formation theory including the role of magnetic fields and ambipolar diffusion.

With new observations at the Green Bank Telescope we have greatly increased the amount of available HINSA data previously obtained using the Arecibo telescope, and though our analysis is still very much preliminary, we are beginning to see that HINSA and its correlations with molecular, IR, and optical data may prove to be a more useful tool in studying dark molecular clouds and other objects than previously anticipated.

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Program and Abstracts

Short talk

SEMI-CLASSICAL AND MODIFIED SEMI-EMPIRICAL IMPACT STARK BROADENING CALCULATIONS OF SINGLY-IONIZED CARBON AND OXYGEN SPECTRAL LINES

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Using the semi-classical impact perturbation theory including both dipole and quadrupole terms in the expression of electrostatic interaction between the optical electron and the perturber, we calculated widths and shifts of singly ionized carbon and oxygen spectral lines and compared with experimental results and those calculated by Griem. Energy levels and oscillator strengths have been taken from TOPbase. Mean radius and mean square radius have been calculated within hydrogenic approximation using the effective quantum numbers n_i^* obtained from TOPbase.

The impact approximation was checked for each case using the appropriate condition of validity (the collision volume must be very small compared to the inverse of the perturber density).

The species of ionic perturbers depends on the plasma composition in a particular experiment but since in stellar plasma the hydrogen is the most abundant element, we provided also the proton-impact Stark widths for possible astrophysical applications.

We also calculated modified semi-empirical widths using the formalism of Dimitrijević and Konjević, where the mean square radius is expressed in terms of the oscillator strengths for the contribution of the collisional transitions with $\Delta n = 0$ and hydrogenic approximation is used for $\Delta n \neq 0$.

Inside the same multiplet, widths and shifts of particular spectral lines in existing experimental data are determined by scaling multiplet values.

The agreement found between experimental and semi-classical values demonstrates that the method can be used for C II and O II Stark width calculations, especially when more sophisticated methods are not applicable in an adequate way.

Short talk

MEASURED STARK SHIFTS OF Kr I LINE PROFILES IN THE 5s-5p AND 5s-5p' TRANSITIONS

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On the basis of the precisely recorded 10 neutral krypton (Kr I) line shapes in the 5s–5p and 5s–5p' transitions, it has been obtained the Stark shift (d) of the neutral krypton (Kr I) spectral lines. These lines have been studied in a linear, low–pressure, optically thin pulsed arc discharge operated in pure krypton. The line shapes are measured at 17 000 K electron temperature (T) and at 16.5x10^{22} m^{-3} electron density (N). The mentioned plasma parameters have been measured using independent experimental diagnostics techniques, as well as from the line deconvolution procedure. The separate electron and ion contributions from the total Stark shift (d_t), i.e. d_e and d_i have been obtained and represent the first experimental data in this field.

On the basis of the observed asymmetry of the Stark broadened line profile it has been deduced the ion broadening parameters which describe the influence of the ion static (A) and the ion–dynamical effect on the shift (E) of these 10 Kr I line shapes. The ion–dynamical parameters of the measured Kr I line shape are the first data in this field, too.

Short talk

THE STARK BROADENING EFFECT IN HOT STAR ATMOSPHERES: Tl II

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Electron-impact broadening is the main pressure broadening mechanism in the hot star atmospheres. Satellite ultraviolet spectral lines observations made by e.g. International Ultraviolet Explorer (IUE) and Goddard High Resolution Spectrograph (GHSR) installed at Hubble Space Telescope provided much better possibilities for the investigations of the trace elements spectral line in stellar atmospheres. Consequently, Stark broadening parameters data for such lines become of interest for stellar spectra interpretation, analysis and modelling as well as for abundance determination.

In order to provide the needed spectroscopic data for singly ionized Thallium spectral lines we present Stark broadening parameters for Tl II spectral lines calculated within the modified semiempirical approach. Calculations were performed within temperature range 5000K-50000K and for an electron density of $10^{23}m^{-3}$.

Short talk

SCANNING FABRY-PEROT INTERFEROMETER IN THE EXTRAGALACTIC RESEARCHES

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The scanning Fabry-Perot interferometer (IFP) is a powerful tool for investigation of kinematics of extended objects by the method of panoramic spectroscopy. IFP allows to obtain a spectral information simultaneously in a large field of view. In this review a main idea of this technique and history of its applications in the astronomy are considered. The opportunities of the IFP are illustrated by the modern observational data from the 6m Russian telescope (SAO RAS). We show some results concerning objects with complex ionized gas kinematics: AGN, barred and spiral galaxies, polar-ring objects etc.

Short talk

THE EXTERNAL MAGNETIC FIELD INFLUENCE ON THE HYDROGEN BALMER LINES PROFILES IN ELECTRIC DISCHARGES

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A surview is given of the results obtained in a study of external magnetic field influence on the shapes of spectral lines from hydrogen Balmer series in abnormal glow discharges under various experimental conditions.

Short talk

THE APPLICATION OF THE CUT-OFF COULOMB POTENTIAL FOR THE CALCULATION OF A CONTINUOUS SPECTRA OF DENSE HYDROGEN PLASMA

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The continuous optical spectrum of dense hydrogen plasma is modeled with the complete quantum mechanical model based on the cut-off Coulomb potential. Here are presented the results of calculation of a continuous optical spectra of dense hydrogen plasma compared with the experimental results obtained in "Laboratory for dense plasma" at the Pierre et Marie Curie University in Paris. The cut-off Coulomb potential gives the opportunity to model the most significant effects in dense plasma. The additional effects, including some of time dependent, which influences the spectral characteristics, could be easily added. This work is a continuation of previous works on conductivity of dense plasma based on cut-off Coulomb potential.

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Short talk

DETECTION OF DARK MATTER IN EARLY-TYPE GALAXIES WITH X-RAY HALOES USING ABSORPTION SPECTRAL LINES

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In this contribution I discuss the existence of dark matter in the early-type galaxies with and without X-ray haloes. I show that using high quality long-slit integrated stellar spectra obtained from various sources related to the field, binary, group and cluster galaxies there is no strong evidence for dark matter out to three effective (half-light) radii.

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Short talk

INFLUENCE OF IMPACTS WITH CHARGED PARTICLES ON Cd I AND F III SPECTRAL LINES IN STELLAR PLASMA (MSc Thesis)

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Data on the Stark broadening of neutral cadmium and doubly ionized fluorine are of interest not only for laboratory but also for astrophysical plasma research as e.g. for stellar spectra analysis and synthesis, for cadmium and fluorine abudance determination and opacity calculations. Abudance analysis for A type stars showed the presence of neutral cadmium in stellar spectra of e.g. 68 Tauri, χ Lupi and V816 Centauri, in distinction from fluorine which cosmic abudance is smaller.

We have calculated within the semiclassical perturbation approach the Stark broadening parameters of 11 Cd I singlets and 13 triplets in ultra-violet and visible, and 24 Cd I triplets in infra red spectral ranges, for temperatures between 2500 K and 50000 K, and for perturber density of 10^{16} cm^{-3}. Also, we have calculated within the same approach such parameters for F III $2p^3\ {}^4S^o$ - $3s\ {}^4P$ resonant line. Moreover, for 10 F III multiplets, line widths have been obtained within the modified semiempirical approach, for temperatures between 10000 K and 300000 K, and for perturber density of 10^{17}cm^{-3}.

We compared our results for Cd I $5p\ {}^3P^o$ - $6s\ {}^3S^o$ multiplet with existing experimental data. Also, for the same multiplet there are theoretical results obtained within GBKO approach.

In the case when there are no reliable data for Stark broadening, investigation of regularities and systematic trends can provide fast estimate of missing values, especially if it is no necessary to have the high accuracy for each particular line, and a good average accuracy for large number of lines is sufficient. We investigated here the regularity within a spectral series of Cd I $5s^2\ {}^1S$ - $np\ {}^1P^o$ and we confirmed such behavior.

We have analyzed the influence of Stark broadening mechanism of neutral cadmium and doubly ionized fluorine in comparison to the Doppler one for A type star atmosphere (T_{eff}=10000 K, log g= 4), close to the conditions for 68 Tauri (T_{eff}=9025 K, log g=3.95). Our results show that Stark broadening data for neutral cadmium and doubly ionized fluorine lines are needed for an adequate description of stellar spectra and plasma modelisation.

Short talk

HEIGHTS OF FORMATION OF Mn I SPECTRAL LINES BROADENED BY HYPERFINE STRUCTURE

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This paper considers the influence of hyperfine broadening on heights of formation of some Mn I spectral lines in Solar spectrum. The comprehensive model atom of neutral manganese is constructed with 64 bound energy levels and continuum and 161 bound-bound transitions. Results of spectrum synthesis for this model and atmospheric models for quiet Sun and plage (Fontenla et al, 1999) are obtained by using program MULTI (Carlsson, 1986). It is shown that pronounced hyperfine structure decreases the height of formation and narrows down the line formation region.

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Short talk

HELIUM LINE SHAPE ANALYSIS IN B TYPE STARS

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A number of He-rich stars and (vsini) standards were observed aiming at disentangling the rotational velocities, helium abundance and its age dependence. The line shape analysis and search for vertical helium stratification in the stellar atmosphere are presented.