

BALTIC ASTRONOMY Vol. 20, No. 3 (2011), ABSTRACTS

**PHOTOMETRY AND CLASSIFICATION OF STARS IN THE
DIRECTION OF THE DARK CLOUD TGU 619 IN CEPHEUS.
II. INTERSTELLAR EXTINCTION AND CLOUD DISTANCE**

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Abstract. Interstellar extinction is investigated in a 1.5 square degree area of the Cepheus Flare in the direction of the dark cloud TGU 619 at $\ell = 102.5^\circ$, $b = +15.5^\circ$. The study is based on photometric classification of 658 stars in spectral and luminosity classes down to $V = 16$ mag using photometry in the *Vilnius* seven-color system published in Paper I (2009). The extinction in the investigated area is very uneven: in the most transparent directions we find an extinction of 0.3–1.1 mag while in the darkest directions the maximum extinction observed is 2.6 mag. The real extinction should be considerably larger since in the direction of some cloud clumps no stars are seen. The distribution of stars in the A_V vs. d plot gives evidence that the dust clouds are located at a distance of 286 ± 20 pc.

Key words: stars: fundamental parameters, classification – Galaxy: Cepheus Flare, – ISM: extinction, clouds: individual (TGU 619)

A NEW DYNAMICAL PARAMETER FOR THE STUDY OF STICKY ORBITS IN A 3D GALACTIC MODEL

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Abstract. A 3D dynamical model is used to study the motion in the central parts of an elliptical galaxy, hosting a massive and dense nucleus. Our aim is to investigate the regular or chaotic character of the motion, with emphasis in the different chaotic components, as well as the sticky regions of the dynamical system. In order to define the character of the motion in the 2D system, we use the classical method of the Poincaré $x - p_x$ phase plane, the Lyapunov Characteristic Exponent (LCE) and the dynamical parameter – the $S(c)$ spectrum. Then the results obtained from the 2D system are used to investigate the properties of the 3D system. For this, we introduce and use a new dynamical parameter, the $S(k)$ spectrum, which proves to be a very reliable and fast method to detect the islandic motion and the evolution of the sticky orbits in the 3D system. Numerical experiments conducted by the new $S(k)$ spectrum suggest that the different chaotic components in the 3D system do not interact for time intervals much larger than the age of the galaxy. The results indicate that the different sticky regions do not lead to a unified chaotic sea. Thus, the behavior of the 3D sticky orbits differs from that observed in the 2D system. Furthermore, the 3D motion near the center of a triaxial elliptical galaxy seems to be very complicated, displaying several families of resonant orbits, different chaotic components and sticky regions, while only a small fraction of orbits is regular. The comparison with earlier results reveals the importance of the conception of the new dynamical spectrum.

Key words: galaxies: kinematics and dynamics

PREFACE

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Abstract. This issue of “Baltic Astronomy” contains the papers presented at the 8th Serbian Conference on Spectral Line Shapes in Astrophysics – SSC-SLSA. The conference was held in hotel Divčibare, on mountain Divčibare, Serbia, 2011 June 5–10. Contributions in this issue are about the investigation of spectral line shapes in extragalactic objects (e.g., active galactic nuclei), stellar atmospheres and astrophysical spectra in general, as well as on atomic spectral line shapes in various discharges and plasma devices.

**SCORPIO ON THE 6 M TELESCOPE: CURRENT STATE AND
PERSPECTIVES FOR SPECTROSCOPY OF GALACTIC AND
EXTRAGALACTIC OBJECTS**

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Abstract. A significant part of observations at the Russian 6 m telescope is carried out using the SCORPIO multi-mode focal reducer. During the past ten years, a lot of scientific data have been collected using observations in the direct imaging, slit spectroscopy and Fabry-Pérot interferometry modes. Some results of these observations are considered in this review. We also present a short description of a new generation instrument named SCORPIO-2.

Key words: instrumentation: spectrograph – instrumentation: polarimeters – ISM: kinematics and dynamics – galaxies: active

**FIR/SUBMM SPECTROSCOPY WITH HERSCHEL:
FIRST RESULTS FROM THE VNGS AND H-ATLAS SURVEYS**

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Abstract. The FIR/submm window is one of the least-studied regions of the electromagnetic spectrum, yet this wavelength range is absolutely crucial for understanding the physical processes and properties of the ISM in galaxies. The advent of the Herschel Space Observatory has opened up the entire FIR/submm window for spectroscopic studies. We present the first FIR/submm spectroscopic results on both nearby and distant galaxies obtained in the frame of two Herschel key programs: the Very Nearby Galaxies Survey and the Herschel ATLAS.

Key words: galaxies: ISM – infrared: galaxies – submillimeter: galaxies

HIGH REDSHIFT QUASARS, EMISSION LINES AND ‘CLOUDY’

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Abstract. I describe some of the outstanding “big picture” questions in quasar research and how the development of the plasma simulation code Cloudy is being guided to answer them. QSO spectra are complex and challenge even the most sophisticated spectral codes. Particular emphasis is given to a central question – how do the properties of the central black hole and the accretion disk are manifested in the observed spectrum.

Key words: galaxies: active, AGN, quasars – quasars: emission lines

VARIABILITY OF DOUBLE-PEAKED EMISSION LINES IN AGNs AS A PROBE OF THE BROAD-LINE REGION STRUCTURE

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Abstract. We demonstrate that the disk-wind model for the broad-line region (BLR) can explain the variability from single-peaked to double-peaked emission line (DPEL) profiles observed in some active galactic nuclei (AGNs) and can produce realistic single-peaked line profiles if the inclination and size of the line-emitting region are restricted. The main drivers of differences in the line profile is the radial density distribution in the wind, which is likely related to the accretion rate of the AGN. We exploit the extreme case of AGNs with DPELs in order to test different models of perturbations in the accretion disk, and find evidences that the outer regions of the disk are likely unstable to self-gravity. Finally, we devise a new monitoring strategy in order to build a rich dataset in a short time.

Key words: galaxies: active – quasars: emission lines

OFF-AXIS VARIABILITY OF AGNs: A NEW PARADIGM FOR BROAD LINES AND CONTINUUM EMITTING REGIONS

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Abstract. The general picture of how thermal AGNs work has become clearer in recent years but major observational puzzles threaten to undermine this picture. These puzzles include AGNs with extremely asymmetric emission line profiles, inconsistent multi-wavelength variability, rapid apparent changes in the sizes of emitting regions and in the direction of gas flow, a curious insensitivity of gas in some narrow velocity ranges to changes in the ionizing continuum, and differing dependences of polarization on gas velocity. It is proposed that all these puzzles can readily be explained by off-axis variability.

Key words: galaxies: active, Seyfert, AGN – quasars: emission lines

ACCRETION DISK STRUCTURE AND KINEMATICS OF THE BROAD LINE REGIONS IN SELECTED AGN

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Abstract. Broad emission line regions in AGN are connected with the outer layers of accretion disks. This has been shown by means of line variability studies of individual AGN as well as line profile studies of AGN samples. We could model the broad-line profiles in AGN in a simple way only through rotational broadening of Lorentzian profiles. To individual emission lines belongs one typical Lorentz profile only with a fixed turbulence velocity: e.g., 500 km/s for H β , 3000 km/s for CIV λ 1550. The rotation velocities in the broad line regions of the AGN range from 1000 to 7000 km/s.

Key words: galaxies: active, nuclei, Seyfert – quasars: emission lines, general

A PHOTO-IONIZATION METHOD FOR BLACK HOLE MASS ESTIMATION IN QUASARS

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Abstract. Determining the masses of the central compact object believed to power all active galactic nuclei is relevant to our understanding of their evolution and of their inner workings. Keys to present-day mass estimates are: (1) the assumption of line broadening due to virial motion of the emitting gas, (2) an estimate of the distance of broad-line emitting gas from the central compact object, and (3) a measure of the AGN luminosity. We discuss the merits and the limitations of an alternative method based on estimates of physical conditions in the broad line emitting region derived from an appropriate multi-component analysis of emission line profiles. This ‘photo-ionization method’, applied to UV intermediate-ionization lines appears to be promising for at least a sizable population of high- z quasars.

Key words: quasars: general, emission lines, individual:
SDSS J120144.36+011611.6

MICROLENSING-BASED STUDIES OF THE UNRESOLVED STRUCTURE OF AGNs AND THE COMPOSITION OF LENSING GALAXIES

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Abstract. Multiple images of quasars formed by gravitational lensing are typically seen through the lensing galaxy. The granulation of the galaxy in stars or other compact objects induces local ('microscopic') but strong fluctuations in the gravitational potential that subdivide each image in several micro-images changing the expected flux of the image (flux anomalies). This phenomenon, quasar microlensing, allows to study both the unresolved structure of the source and the composition of the lensing galaxy. We have applied a statistical analysis based on caustic crossing to the multiply imaged quasar QSO B2237+0305. The results indicate that the abundance of low-mass stars in the distribution of microlenses could be estimated with 10 years of monitoring.

Key words: gravitational lensing – galaxies – active, AGN, quasars: individual: QSO B2237+0305

THE STARBURST – AGN CONNECTION: A CRITICAL REVIEW

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Abstract. Nuclear activity and star formation processes represent two key elements in the evolution of galaxies across the cosmic ages. In spite of very different physical backgrounds, several arguments suggest that they should be closely connected. On the basis of simple theoretical considerations, the transport of appreciable amounts of fuel to the AGN scale is very likely to trigger star formation in the gas. Young stellar populations, in their turn, are expected to affect the properties of the interstellar medium, leading to a complex balance of interactions among nuclear activity and star formation. This scenario is also supported by the observation of super-massive black holes and host galaxy properties, which strongly suggest a common evolutionary track. However, despite several years of extensive investigation, the relationship among the two processes still has to be properly explained. Here we provide a review of some of the most important observations, which are relevant to the issue of the connection among AGN and starburst events. Based on a wide sample of observations, we present an analysis of the spectral signatures connected with AGN and star formation activity. Expanding the concept of the distinction among star forming galaxies and the true active nuclei, we provide systematic evidence for a role of recent starburst events in the circum-nuclear regions of active galaxies and discuss the possibility of its influence onto the AGN environment. We also analyze the age, mass and metallicity properties of star-forming and active galaxies, illustrating that they are arranged in a sequence that is consistent with the identified relation.

Key words: galaxies: active, star formation, stellar content

THE CASE FOR TWO QUASAR POPULATIONS

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Abstract. We present evidence for two populations of quasars showing distinctly different broad line structure and kinematics. The first evidence for quasar dichotomy involve differences between radio-quiet and radio-loud sources. We proposed an alternate population A–B dichotomy based on optical, UV and X-ray spectroscopic properties. One of these populations (Pop. A: FWHM $H\beta < 4000 \text{ km s}^{-1}$) is largely radio-quiet, while Pop. B (FWHM $H\beta > 4000 \text{ km s}^{-1}$) includes most radio-loud sources and a significant number of spectroscopically indistinguishable (as far as the low-ionization lines are concerned) radio-quiet sources. Comparison of multiwavelength measures for population A and B sources reveals more/larger differences than are found between radio-quiet and radio-loud sources leading us to conclude that the population A–B distinction is more fundamental. The major physical driver of these differences is likely the Eddington ratio where the Pop. A sources show $\log L/L_{\text{Edd}} = 0.2\text{--}1.0$, and the Pop. B sources show $\log L/L_{\text{Edd}} = 0.01\text{--}0.2$ (for black hole masses $\log M_{\text{BH}} \approx 8.5$).

Key words: quasars: general – quasars: emission lines

**EQUIVALENT WIDTH MEASUREMENTS IN OPTICAL
SPECTRA OF GALAXIES IN LOCAL CLUSTERS:
HINTS ON THE STAR FORMATION HISTORY IN CLUSTERS**

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Abstract. Equivalent widths of spectral lines in the optical spectra of galaxies are commonly used to characterize their stellar populations and to get some insight on their evolution. Here we describe a new method to measure automatically equivalent widths of spectral lines with a good accuracy. This makes possible to classify galaxies according to the presence/absence and intensity of [O II] and H δ lines. Based on these classification criteria, we give a description of the characteristics of the star-forming and post-starburst galaxies in local clusters, and their dependence on the cluster characteristics.

Key words: galaxies: classification, starburst, clusters

OPTICAL EMISSION LINES AND THE X-RAY PROPERTIES OF TYPE 1 SEYFERT GALAXIES

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Abstract. In this contribution we report on the study of the optical emission lines and X-ray spectra of a sample of Type 1 AGNs, collected from the SDSS database and observed by the XMM-Newton satellite. Using different instruments onboard XMM, we identify the spectral components of the soft and hard energy bands (in the range from 0.3 keV to 10 keV). The properties of the X-ray continuum and of the Fe K α line feature are related to the optical broad emission line profiles and intensity ratios. The resulting picture of emission, absorption and reflection processes is interpreted by means of a structural model of the broad line region, developed on the basis of independent optical and radio observations.

Key words: galaxies: active – galaxies: Seyfert – quasars: emission lines

THE COMPLEX BROAD ABSORPTION LINE PROFILES IN A SAMPLE OF QSO SPECTRA

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Abstract. Most of the Broad Absorption Lines (BALs) in quasars show very complex profiles. An idea to explain these profiles is that the dynamical systems of broad line regions are not homogeneous but consist of a number of dense regions or ion populations with different physical parameters. This approach is used to study the ultraviolet CIV resonance lines in the spectra of a group of high ionization BAL quasars, using the Gauss-Rotation model.

Key words: quasars: absorption lines

A COMPLEX STELLAR LINE-OF-SIGHT VELOCITY DISTRIBUTION IN THE LENTICULAR GALAXY NGC 524

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Abstract. We present a detailed study of the stellar and gaseous kinematics in the luminous early-type galaxy NGC 524, derived from the long-slit spectroscopic observations obtained with the Russian 6 m telescope and the IFU data from the SAURON survey. The stellar line-of-sight velocity distribution (LOSVD) of NGC 524 exhibits strong asymmetry. We performed a comprehensive analysis of the LOSVD using two complementary approaches by the NBURSTS full spectral fitting technique: (a) a non-parametric LOSVD recovery and (b) a parametric recovery of two Gaussian kinematical components having different stellar populations. We discuss the origin of the complex stellar LOSVD of NGC 524.

Key words: galaxies: kinematics and dynamics: individual (NGC 524)

OBSERVATIONS OF THE GALAXY NGC 3077 IN THE NARROW-BAND [S II] AND H α FILTERS

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Abstract. We present observations of the HI tidal arm near a dwarf galaxy NGC 3077 (member of the M81 galaxy group) in the narrow-band [S II] and H α filters. Observations were carried out in 2011 March with the 2 m RCC telescope at the NAO Rozhen, Bulgaria. Our search for possible supernova remnant candidates (identified as sources with enhanced [S II] emission relative to their H α emission) in this region yielded no sources of this kind. Nevertheless, we found a number of objects with significant H α emission that probably represent uncatalogued, low brightness H II regions.

Key words: ISM: H II regions, supernova remnants – galaxies: individual (NGC 3077)

THE RELIABILITY OF [C II] AS A STAR FORMATION RATE INDICATOR

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Abstract. We present a calibration of the star formation rate (SFR) as a function of the [C II] 157.74 μm luminosity for a sample of 24 star-forming galaxies in the nearby universe. In order to calibrate the SFR against the line luminosity, we rely on both GALEX FUV data, which is an ideal tracer of the unobscured star formation, and Spitzer MIPS 24 μm , to probe the dust-enshrouded fraction of star formation. For this sample of normal star-forming galaxies, the [C II] luminosity correlates well with the star formation rate. However, the extension of this relation to more quiescent ($\text{H}\alpha$ EW ≤ 10 Å) or ultra luminous galaxies ($L_{\text{TIR}} \geq 10^{12} L_{\odot}$) should be handled with caution, since these objects show a non-linearity in the $L_{[\text{C II}]}$ -to- L_{FIR} ratio as a function of L_{FIR} (and thus, their star formation activity). Two possible scenarios can be invoked to explain the tight correlation between the [C II] emission and the star formation activity on a global galaxy-scale. The first interpretation could be that the [C II] emission from photo dissociation regions arises from the immediate surroundings of actively star-forming regions and contributes a more or less constant fraction on a global galaxy-scale. Alternatively, we consider the possibility that the [C II] emission is associated to the cold interstellar medium, which advocates an indirect link with the star formation activity in a galaxy through the Schmidt law.

Key words: galaxies: star formation – ISM: lines and bands – infrared: galaxies – ultraviolet: galaxies

INFLUENCE OF BLACK HOLE SPIN ON THE SHAPE OF THE Fe K α SPECTRAL LINE: THE CASE OF 3C 405

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Abstract. Here we analyze how the angular momenta (spins) of black holes in the centers of Active Galactic Nuclei (AGN) affect the shape of the Fe K α line emitted from their accretion disks. For that purpose, we compared the observed line profile in the case of radio galaxy 3C 405 (Cygnus A) with its profiles, obtained by numerical simulations based on ray-tracing method in the Kerr metric. Our results show that the spins of rotating central black holes of AGN have significant influence on their Fe K α line shapes. Also, we found that in the case of Cygnus A the observed line is probably emitted from the innermost region of its slightly inclined accretion disk around very slowly rotating or even stationary central black hole.

Key words: galaxies: active: individual (3C 405, Cygnus A) – X-rays: galaxies

HINTS ON THE BROAD LINE REGION STRUCTURE OF QUASARS AT HIGH AND LOW LUMINOSITIES

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Abstract. Quasars show a considerable spectroscopic diversity. However, the variety of quasar spectra at low redshifts is non-random: a principal component analysis applied to large samples customarily identifies two main eigenvectors. In this contribution we show that the range of quasar optical spectral properties observed at low- z and associated with the first eigenvector is preserved up to $z \approx 2$ in a sample of high luminosity quasars. We also describe two major luminosity effects.

Key words: quasars: general – quasars: emission lines

**SPECTRAL MONITORING OF AGN: PRELIMINARY RESULTS
FOR Ark 564 AND Arp 102B**

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Abstract. We present preliminary results of the long-term spectral monitoring of two active galactic nuclei with different broad line shapes: Ark 564 and Arp 102B. Ark 564 is a bright nearby narrow-line Seyfert 1 (NLS1) galaxy with relatively narrow permitted optical emission lines and a high Fe II/H β ratio, while Arp 102B is a nearby broad-line radio galaxy with broad double-peaked Balmer emission lines. The spectra of Ark 564 were observed during 11-year period (1999–2009) and the spectra of Arp 102B in the 12-year period (1998–2009), with SAO 6 m and 1 m telescopes (Russia) and the OAGH 2.1 m telescope (Cananea, Mexico).

Key words: galaxies: active, Seyfert, individual (Ark 564, Arp 102B)

INFLUENCE OF MICROLENSING ON SPECTRAL ANOMALIES OF THE LENSED OBJECTS

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Abstract. Here we consider the influence of microlensing on the spectrum of a lensed object with the angular size $5 \mu\text{as}$ accepting that the composite emission of this object originates from three different regions arranged around its center. We assume that the lensed object has three concentric regions with a black-body emission; the temperatures of these regions are 10 000 K, 7500 K and 5000 K. We investigate how the integral spectral energy distribution (SED) of such stratified source changes due to microlensing by a group of solar-mass stars. We find that the SED and flux ratios in the photometric B , V and R passbands show considerable changes during a microlens event. This indicates that the flux anomaly observed in some lensed quasars may be caused by microlensing of a stratified object.

Key words: gravitational lensing: microlensing

GAS MOTION MAPPING FOR THREE SEYFERT GALAXIES

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Abstract. We report the preliminary results of a kinematical study of three Seyfert galaxies selected from a sample of nearby active galactic nuclei observed using 3D spectroscopy. The observations were performed at the prime focus of the 6 m telescope of SAO RAS with the integral-field spectrograph MPFS and with a scanning Fabry-Pérot interferometer, installed on the multimode device SCORPIO. Based on these data, the monochromatic maps and velocity fields in different emission lines were constructed. We have detected the nuclear outflow or ionized gas motions associated with a radio jet in all the circumnuclear regions of these galaxies.

Key words: galaxies: active, Seyfert, interactions, kinematics and dynamics, starburst, individual (Mrk 198, Mrk 291, Mrk 348)

AGN DUSTY TORI AS A CLUMPY TWO-PHASE MEDIUM: THE 10 μm SILICATE FEATURE

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Abstract. We investigated the emission of active galactic nuclei dusty tori in the infrared domain, with a focus on the 10 μm silicate feature. We modeled the dusty torus as a clumpy two-phase medium with high-density clumps and a low-density medium filling the space between the clumps. We used a three-dimensional radiative transfer code to obtain spectral energy distributions and images of tori at different wavelengths. We calculated a grid of models for different parameters and analyzed the influence of these parameters on the shape of the mid-infrared emission. A corresponding set of clumps-only models and models with a smooth dust distribution is calculated for comparison. We found that the dust distribution, the optical depth and a random arrangement of clumps in the innermost region, all have an impact on the shape and strength of the silicate feature. The 10 μm silicate feature can be suppressed for some parameters, but models with smooth dust distribution are also able to produce a wide range of the silicate feature strength.

Key words: galaxies: active, nuclei, Seyfert – radiative transfer