We present the main results from a selection of optical spectra of Seyfert and LINER galaxies taken from the 9^{th} release of the SDSS with detectable emission of forbidden high ionization lines (FHILs), better known as coronal lines. A catalog of 345 Seyfert 1 (Sy1) and Seyfert 2 (Sy2) galaxies with FHILs emission is presented. By analyzing their spectra and utilizing data from the literature we found the following results: (1) The flux ratios between FHILs suggests anisotropy of emission between Sy1 and Sy2 galaxies, which agrees with the results found by Nagao et al. (2002) and Portilla (2012). Sy1 seems to emit more FHILs than Sy2. (2) This anisotropy suggests the idea that an important, but not the majority, of the emission of FHILs comes from the inner part of the obscuring torus. (3) We present diagnostic diagrams between FHILs lines which indicate clear correlations between the flux ratios. (4) It is observed that the ratio of Ne V/Fe VII is of the order of 3 to 10, while the ratios between iron lines (i.e., Fe VII, Fe X, Fe XI) are roughly around the unity. (5) At least in the optical spectra, the present study continues to support the general idea that LINERs are not energetic enough to present FHILs. A complete version of this study including the catalog with the objects of study, and diagnosis diagrams using only this kind of lines can be found in Vera & Portilla (in prep).

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HIGH ENERGY ASTROPHYSICS

DECAY OF MAGNETIC FIELD IN BLACK WIDOW PULSARS

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A small fraction of the binary relativistic systems display the "black widow" effect: the companion is being ablated by the (recycled) pulsar wind. In these binary systems the evolution of the companion star (of the solar-type) reaches the point of filling its Roche lobe, thus initiating the process of mass accretion onto the pulsar. Accretion is generally believed to result in magnetic field decay, while isolated neutron star fields decay very slowly, if at all. We shall show that the very long evolution of the "black widow" system, starting from a solar-type star and lasting > 5 Gyr to reach the observed position in the plane, allows us to conclude that the magnetic field does not decay below the bottom value , extending the previous conclusions drawn from younger systems. In addition, the masses of the "black widow" pulsars are naturally predicted to be > 2 Mo due to the accretion history, in full agreement with recent measurements.

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RADIATION-HYDRODYNAMIC MODEL OF HIGH-MASS X-RAY BINARIES

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The topic of circumstellar matter in the X-ray binaries and its spectroscopic diagnostics is addressed by method of generating synthetic Dopplerograms for direct comparison with observations. The presented results were obtained using our improved three-dimensional radiation-hydrodynamic model of the stellar wind in HMXBs. We use the model to simulate dynamics, anisotropy and other characteristics of the wind, e.g. the density distribution and ionization structure. We adopt parameters of Cygnus X-1 in our simulations and use the Doppler tomography to probe the structure of radiation-emitting material in the system. We introduce a data interpretation method of observed Doppler tomograms via direct comparison with synthetic Dopplerograms obtained from our model. We test the reliability of the model as well as set constrains on various physical parameters and processes, e.g. the accretion rate. We take into account the Coriolis force, the ionization structure of the medium, the gravity darkening, and we investigate the effects these phenomena have on the accretion process. E.g. the Coriolis force substantially influences the mass-loss of the donor and by that the accretion rate of the compact companion. Additionally, focusing of the stellar wind by the gravitational field of the compact companion leads to the formation of an unstable gaseous tail behind the companion. This tail shows signs of quasi-periodic oscillations and its existence presents us with other means to explain the switching mechanism among the various X-ray states.

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RUNAWAY MASSIVE STARS AS A NEW CLASS OF GALACTIC GAMMA-RAY SOURCES

M. V. del Valle[1] and G. E. Romero[1]

Runaway stars have high spatial velocities, $V > 30$ km s^{-1}, and if the are massive, can produce bowshocks in the surrounding ISM. These bowshocks develop as arc-shaped structures pointing in the same direction as the supersonic stellar velocity. The piled-up shocked matter emits thermal radiation. Additionally, a population of locally accelerated relativistic particles can produce non-thermal emission over a wide range of energies. This has been recently confirmed by a bunch of observations at radio, X-ray and even gamma-ray wavelengths. Runaway early-type stars might be variable gamma-ray sources, with variability time scales depending on the scales of density inhomogeneities in the medium and the stellar velocity. Protons can easily escape from the emitting region without much loss on energy. These protons might diffuse in the surrounding molecular cloud interacting with the matter via p-p inelastic collisions. These yield gamma rays and secondary particles. Molecular clouds illuminated by these relativistic particles might become into diffuse non-thermal sources. We calculate all relevant nonthermal processes related to these stellar objects and discuss the observational prospects.

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THE GALACTIC DISTRIBUTION OF FERMI POINT SOURCES

F. Jablonski[1] and P. Polido[1]

The second catalog of high-energy γ-ray sources detected by the Large Area Telescope (LAT), the primary science instrument on the *Fermi Gamma-ray Space Telescope*, allows us for the first time to perform a modeling of the galactic distribution of such sources based on the method of summing up all detectable sources in a grid of lines of sight. The challenge is to produce reliable estimates of counts from small numbers. The catalog contains 1873 sources over the whole sky, giving an average of 0.036 counts/deg^2 for $|b| > 60°$. In a narrow strip centered at $|b| < 0.5°$ we find 128 sources. In this work, we describe our attempts to estimate the density of γ-ray sources along both galactic longitude and galactic latitude. The results of the estimated source counts are compared with the predictions of a model which has an exponential distribution in the radial direction as well as an exponential distribution above the galactic plane. Our conclusions point to a radial length scale consistent with that obtained from near-infrared counts and a very short height scale, typical of very young populations in the Galaxy. We tested both Gaussian and Power-Law forms for the luminosity function. The luminosities cover the range $10^{33} - 10^{36}$ erg/s in the 100 MeV–100 GeV band with space densities (in the solar neighborhood) of $\sim 10^{-8}/\text{pc}^3$.

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A MAGNETIC RECONNECTION MODEL FOR EXPLAINING MICROQUASARS RADIATION

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Very high energy observations of AGNs and microquasars are challenging current theories of particle acceleration (mostly based on shock acceleration) which have to explain how particles are accelerated to energies above TeV in very compact regions compared to the characteristic scales of their sources. The identification of microquasars and AGNs as sites of particle acceleration raises many fascinating and important questions. Recent magnetohydrodynamical studies have revealed that cosmic ray acceleration by fast magnetic reconnection can be rather efficient because a first-order Fermi process may occur. In this work, we discuss this acceleration mechanism in the coronal region of the accretion disk around microquasars and AGNs. In addition, the accelerated particles lose substantial amounts of their energy due to non-thermal interactions with the surrounding magnetic field, matter and radiation fields. We compute the corresponding acceleration rate and the relevant loss rates in order to reproduce the observed spectral energy distribution for two microquasars (Cygnus-X1, Cygnus-

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