VII SERBIAN CONFERENCE ON SPECTRAL LINE SHAPES IN ASTROPHYSICS
15-19 June 2009, Zrenjanin, Serbia
Book of Abstracts, Eds. L. Č. Popović, M. S. Dimitrijević, D. Jevremović and D. Ilić
Serbian Astronomical Society and Astronomical Observatory, Belgrade, 2009

Invited lecture

WHAT SPECTRAL LINE SHAPES TELL US ABOUT HOW AGNs WORK

Martin Gaskell

Astronomy Department, University of Texas, Austin, TX 78712-0259, USA
E-mail: gaskell@astro.as.utexas.edu

Two necessary steps in understanding how AGNs work, and using them to probe the cosmic evolution of supermassive black holes, are knowing what AGNs look like, and knowing how the material in them is moving. The total and polarized fluxes of the broad emission lines of AGNs give our most important probe of the structure and kinematics of the material around the central black holes. Thanks to these studies, a fairly consistent picture of the structure and kinematics of the broad-line region gas is emerging. Single-epoch, time- averaged, or root-mean-square profiles all show that the widths of broad lines increase with ionization potential, and that the profiles of high-ionization lines are systematically blueshifted with respect to the low-ionization lines. The profiles of low-ionization lines probably all have a component with displaced double peaks, which indicates Keplerian motion in the equatorial plane. Time variability of the total fluxes of broad emission lines gives responsivity-weighted radii of the emitting regions. These radii are correlated with the velocity of the gas and with ionization potential. Time variability of the line shapes shows that the bulk of the gas responsible for the observed broad emission lines is virialized, and that there is also a net inflow of this gas. The blueshifting of the high-ionization lines shows that there is increasing scattering in the inner regions. Energetic considerations, and the lack of observed absorption from the broad-line region, require the gas to have a flattened distribution with a covering factor similar to that of the dusty torus. This high covering factor, and the statistics of the shapes of the broad lines, require there to be a substantial component of motion perpendicular to the equatorial plane. Despite the consistency of this overall picture of the broad line region and torus, a large number of fascinating questions remain that require further observational and theoretical study.