A Search for HI Absorption against Gravitational Lenses

McMahon, P.M.; Moore, C.; Hewitt, J.N.; Rupen, M.P.; Carilli, C.L.

Session 12: Absorption Lines in QSOs
Display Session
Grand Ballroom

12.01

Analysis of Far-UV High Excitation Line Emission Detected in the Gravitational Lens Q0957+561 with IUE-NEWSIPS

A.G. Michalitsianos, S.P. Maran, D. Kazanas, Y. Kondo (NASA/GSFC), F.C. Bruhweiler (Catholic U.), J. Nichols-Bohlin, M. de la Pena, T. Meylan, M. Perez, R. Thompson (IUE OBS-CSC)

We have continued analysis of far-UV high excitation emission lines which were detected in the double lens quasar 0957+561 during test runs of the New Spectral Image Processing System (NEWSIPS) of data obtained from the International Ultraviolet Explorer (IUE) archive (Michalitsianos et al., ApJ. Lett., Nov. 10, 1993). The significant reduction of fixed-pattern background noise, and the use of a signal-weighted extraction slit, which was applied to 10 co-added LWP (2000-3200A) spectra, revealed the presence of emission lines of S VI 933,945A, C III 978A, N III 992A, S IV 1063-1073, N II 1084A, O VI 1031,1037A and Fe III(UV1;1125A), in addition to Ly-alpha 1215A and N V 1240A previously reported. These identifications assume rest wavelengths consistent with the z = 1.41 redshift of the lensed quasar. We also found strong Ly-beta 1020A absorption at a redshift consistent with a previously reported damped Ly-alpha system at z = 1.3911, which is probably associated with an intervening gas near the quasar. The strong discontinuity in the continuum at 912A is appropriate to absorption that corresponds to the Ly-alpha and Ly-beta absorption line system at a z = 1.3911. The expected far-UV emission lines strengths appropriate for a QSO (assuming solar elemental abundances) were calculated using the photo-ionization code CLOUDY, where we assumed a power-law synchrotron flux distribution with slopes that range from -0.5 to -1.5, and ionization and density parameters appropriate for the QSO broad line region. These results predict strong features that correspond to the emission lines identified here. The relative intensities of emission lines present in the lens images A and B were obtained to determine if gravitational lensing leads to flux variations of different ionic species, which sets constraints on the size of the quasar emitting regions.

12.02

LY-α LINE EMISSION IN A FIELD OF SUPER-CLUSTERED DAMPED LY-α ABSORBERS

Palle Møller (European Space Agency, Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA), Stephen J. Warren (Nuclear and Astrophysics, University of Oxford, Keble Road, Oxford OX1 3RH, UK)

The quasar pair Q2138-4427 and Q2139-4434 is separated by 8 arcmin on the sky ($\approx$ 6 Mpc), and they have correlated damped Lyα absorption (DLA) at two redshifts, z=2.380 and z=2.853 (Francis, P. J., and Hewett, P. C., 1993, *A. J.*, **105**, 1633).

On three nights in September 1993 we imaged the field of Q2138-4427 in B, I, and a narrow band tuned to the DLA at z=2.853. The observations were carried out with the ESO 3.6m telescope. We find two emission line candidates in the field. The two candidates have line fluxes similar to the three sources found in the field of Q0528-250 (Møller, P., and Warren, S. J., 1993, *Astr. Ap.*, **270**, 43) but they are much brighter in the continuum. The two candidates are lying quite far from the quasar, so even if they are spectroscopically confirmed to be Lyα emitters, they are unlikely to be identified with the absorber. Their continuum fluxes make them more likely to be either OII emitters at low redshift, or high redshift AGNs associated with the super-cluster structure reported by Francis and Hewett. Lyα emission sources similar to the ones detected in the field of Q0528-250 are not seen. A comparison of these new results with our previous detections will allow us to draw general conclusions on the nature of the damped systems.

12.03

A Search for HI Absorption against Gravitational Lenses

P.M. McMahon, C. Moore, J.N. Hewitt (MIT), M.P. Rupen (NRAO), C. Carilli (Leiden University)

We observed the radio spectrum of two gravitationally lensed sources, MG 0414+0534 and PKS 1830-211, to search for neutral hydrogen absorption associated with the foreground lensing galaxies. The primary purpose of these observations is to determine the redshift of the lensing galaxies, which are both extremely faint, making optical determinations difficult at best. The observations were performed on the Greenbank 140′ telescope using the spectral processor. The observed frequency range extends from 750 to 1000 MHz, corresponding to a redshift range of $0.42 \leq z \leq 0.9$, and covers most of the range in redshifts predicted by lensing models. The main difficulty with observations in this frequency range is severe interference from a variety of sources. We discuss several methods of minimizing the effects of such interference and present our results in terms of optical depth limits as a function of wavelength.

12.04

Optical and Radio Observations of 4C 39.29, a Radio Galaxy Behind the Cluster Abell 963

R. J. Lavery (ISU), F. N. Owen (NRAO), J. P. Henry (IfA-UH)

The radio source 4C 39.29 has been identified with a R = 18.5 mag galaxy in the field of the rich cluster of galaxies A963 (z = 0.2). The radio properties of this source suggest that it is probably not associated with the cluster. Spectroscopic observations of the 18.5 mag galaxy have revealed an absorption line spectrum, typical of elliptical galaxies, with a redshift of 0.2, the redshift of A963. Superposed on this absorption line system is a set of emission lines, which can be identified as [O II] and [O III] at a redshift of 0.536. There is some evidence that the R = 19.6 galaxy located 4" north of the brighter galaxy is also at this higher redshift.

VLA maps of this source, obtained at 2 and 3.6 cm in A configuration, show a double-lobed radio structure. The central source is coincident with the R = 19.6 mag galaxy. The northern jet has a structure similar to that of normal radio jets, while the southern jet is much more complex in structure. This jet has two extremely intense hotspots which lie behind the R = 18.5 mag galaxy. It is possible that these hotspots have some associated emission-line gas which was detected in the original spectroscopic observations. There is an additional region pf bright emission that is non-colinear with the central source and the two hotspots. Gravitational lensing may play a role in producing this complex radio structure.

12.05

The HST/FOS Ultraviolet Absorption Spectrum of the QSO PG 1522+101

A. Diplas, R. D. Cohen, E. A. Beaver, E. M. Burbidge, V. T. Junkkarinen, and R. W. Lyons (CASS/UCSD)

We present an analysis of the absorption line spectrum of the bright QSO PG 1522+101 (z_{em} = 1.321, V = 15.65, B = 15.8). The data were obtained at a resolution of $\simeq$ 1200, using the high resolution gratings G190H and G270H of the HST FOS. The wavelength coverage of the observations is from 1590Å to 3300Å (685Å to 1413Å in the QSO rest frame). The spectrum exhibits high signal to noise (between 20 and 40) for most of the wavelength range covered.

We identify 98 lines at a significance level of 4.5σ. Most of lines detected are due to Lyman α forest absorption, but we also detect a significant number of intergalactic metal lines as well as interstellar Milky Way absorption. Our aim is to study the evolution of the Lyman α forest and metal absorption lines. Furthermore, the high galactic latitude of the QSO (b = 50°) makes this line of sight ideal for study of the Galactic Halo.

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