A Low Metallicity Cloud at the Disk-Halo Interface

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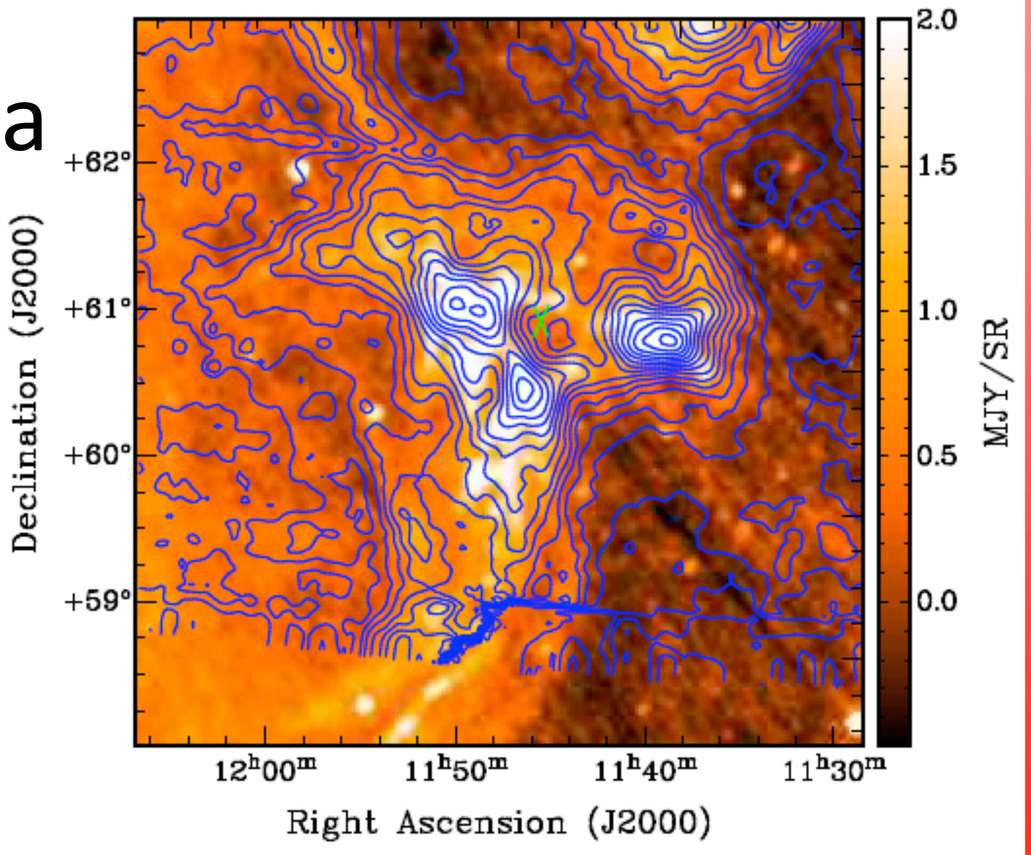
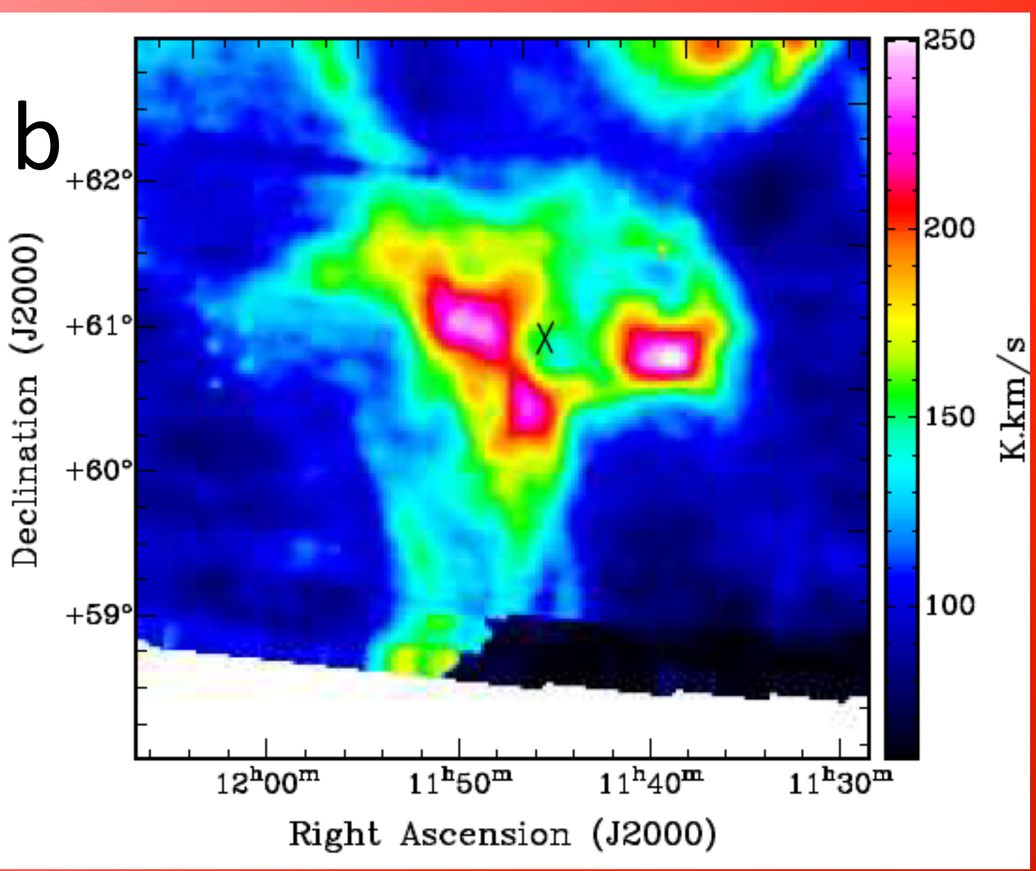
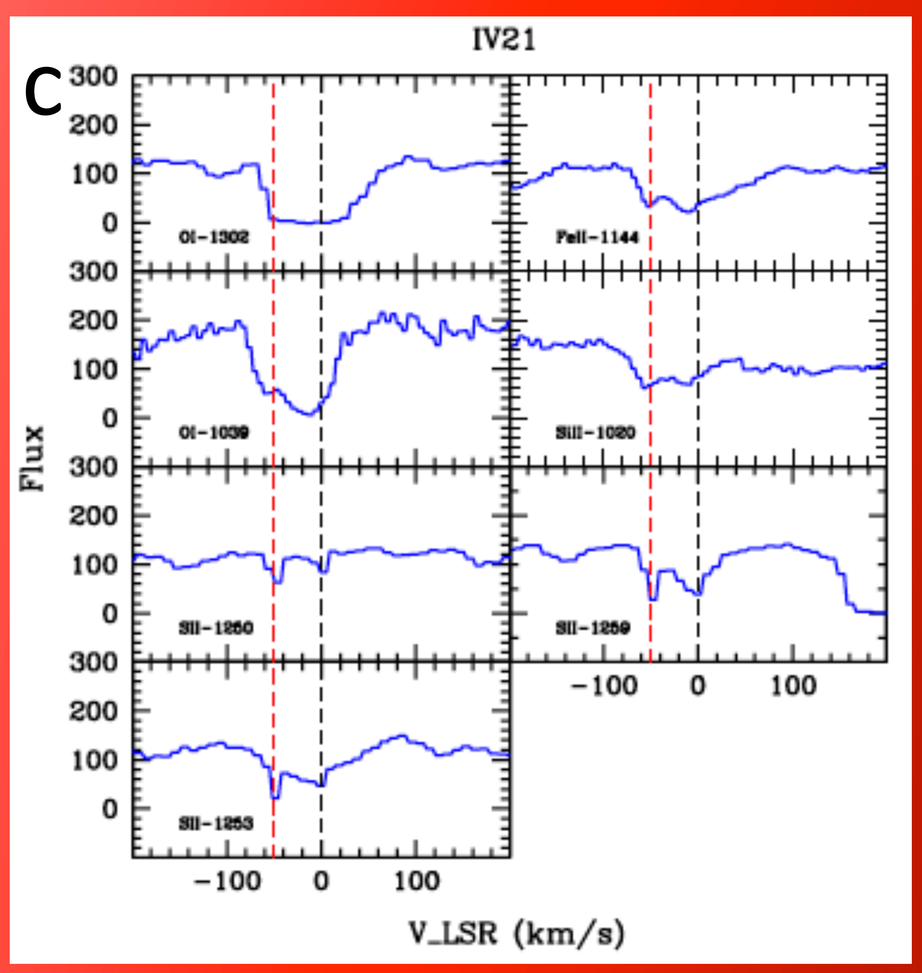


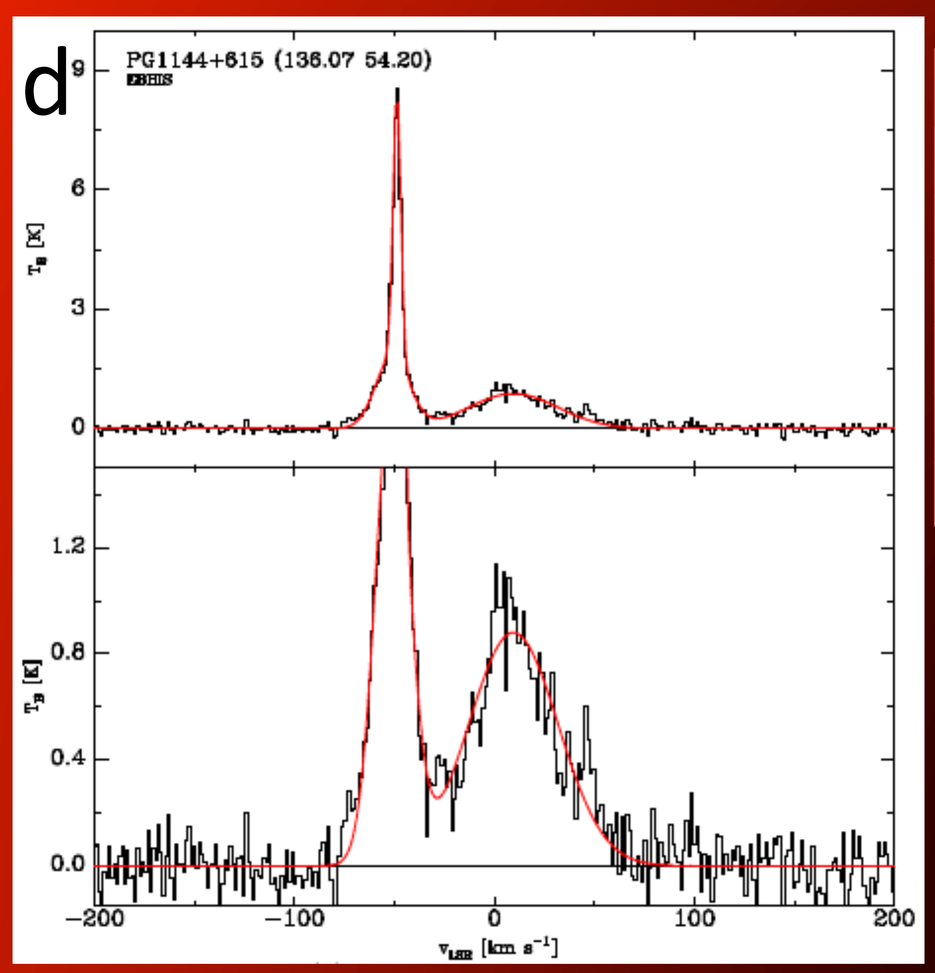


Summary

Identified by their HI emission within the galactic halo, intermediate-velocity clouds (IVCs) have radial velocities that fail to be explained by simple models of galactic rotation. Their origins remain unclear. However IVCs are generally thought to originate as the returning flows of the galactic fountain or the result of extragalactic infall. IV21 (IVC135+54-45) is located in the galactic disk-halo interface (see Weiss et al. 1999), and is one of only six IVCs known to contain molecules (Magnani & Smith 2010). In this study we present a preliminary metallicity estimate for IV21. Using FUSE and STIS absorption-line spectra of the sdB star PG1144+615, located at a distance of ~1kpc and at a projected distance of 16.1 pc from the cloud's densest core, we estimate column densities from the OI, SI, SiII, and FeII lines. We compare these to an estimate of the HI column density in the direction of PG1144+615 by fitting a gaussian to new 21-cm line observations of the entire IV21 region taken with the Effelsberg 100-m telescope as part of the Effelsberg HI Survey (EBHIS). From our analysis, we find that compared to the solar abundances described in Asplund et al. (2009), IV21 has very low metallicity, with [SII/HI] ~ -0.5 dex, [OI/HI] ~ -1.8 dex, and [FeII/HI] ~ -1.7 dex. We also detected H_2 with column density log N (H_2) = 16.80 +0.17 -0.26 and FWHM = 6.5 ± 0.5 km/s with associated excitation temperatures of T_{01} = 139 ± 50 K and T_{12} = 154 ± 12 K. Note that line saturation does not appear to be a problem for SII, while in the case of OI our preliminary analysis has not yet addressed this issue.

a) IRAS 100 micron image of the IV21 cloud. The image has a 5 deg bounding box and a pixel scale of 1.5'. Contours show the total HI column density , with level steps equivalent to 3σ. This map was provided by Benjamin Winkel of Bonn, as part of the on going EBHIS survey. The location of PG1144+615 is indicated by the green 'X'. **b)** HI integrated intensity map with the same bounding box as the IRAS 100 micron image and a pixel scale of 3'. **c)** Examples of FUSE absorption spectra for selected ions towards PG1144+615. The IVC velocity is marked by the red dashed line. **d)** HI line spectrum towards PG1144+615 (black) and fitted gaussian model (red). The total column density estimated by our model is log N(HI)=20.11±0.02 cm^{-2}.





	logNa(v) (cm^{-2})	$Z/HI_{\odot}$	Z/HI_{*}	[Z/HI]
OI-1039.2	15.04 ±0.04	-3.31	-5.07±0.03	-1.76±0.03
SII-1250.5	14.80±0.03	-4.88	-5.31±0.02	-0.43±0.02
SII-1253.8	14.75±0.05	-4.88	-5.36±0.04	-0.48±0.04
SII-1259.5	14.63±0.02	-4.88	-5.48±0.01	-0.60±0.01
SiII-1020.6	14.69±0.04	-4.49	-5.42±.03	-0.93±0.03
FeII-1144.9	13.91±0.06	-4.50	-6.20±0.05	-1.70±0.05

References:

Asplund, M., Grevesse, N., Sauval., A, Scott, P.,2009, ARAA, 47, 481.
Magnani, L., Smith, A., 2010, ApJ, 722, 1685.
Weiss, A., Heithausen. A., Herbstmeier, U., Mebold, U., 2009, A&A, 344, 955.