low isotopic ratio (\(^{12}\text{C}/^{13}\text{C}\)) possibly as low as or lower than 2, giving Frosty the lowest value ever reported for K giants. We will discuss the relation of this object to others with large Li abundances and small carbon isotope ratios, such as the other Li-rich K giants and the J-type carbon stars.

Session 98: AGN-Absorption/Emission Display Session, 9:20am-4:00pm Metropolitan Ballroom

98.01
The Sub–Parsec H\(_2\)O Maser and 22 GHz Continuum Emission in NGC 3079
A. Trotter, J. Moran, L. Greenhill (CFA)

We have imaged the parsec–scale H\(_2\)O maser and 22 GHz continuum emission in the nucleus of the active galaxy NGC 3079 at a resolution of 1 mas using the VLBA. The brightest maser feature served as a phase reference to register the relative position of the continuum emission to an accuracy of 0.1 mas. The maser emission appears to sample a 22 mas (1.7 pc) linear structure that is approximately aligned with the major axis of the galactic disk, with a position angle of −15\(^\circ\). The positions and velocities of the features do not, however, exhibit any conspicuous pattern such as would be expected for a rotating disk. The maser emission is concentrated in three regions: one clump about 4 mas (0.3 pc) in diameter, centered on the brightest feature, that exhibits a wide range of velocities (940–1060 \(\text{km s}\)\(^{-1}\)); another smaller clump 7 mas to the north; and a single feature 15 mas to the south. All of the maser emission occurs at velocities blueshifted with respect to the systemic velocity of the galaxy (\(v_{\text{sys}}\) = 1130 \(\text{km s}\)\(^{-1}\)) except for the single southern feature, which has a velocity of 1190 \(\text{km s}\)\(^{-1}\). One 22 GHz continuum component was convincingly identified. It is compact, with a flux density of about 10 mJy, and lies 6.6 mas (0.5 pc) west of the dominant maser emission. None of the maser components is spatially coincident with the 22 GHz continuum. Hence, the extraordinary brightness of the H\(_2\)O maser emission in NGC 3079 may not result from highly beamed amplification of radiation from compact background continuum features, as has been suggested.

98.02
Physical properties of the molecular gas in Seyfert 1 and Seyfert 2 Galaxies, a Comparative Study
P.P.Papadopoulos, E.R.Sequist (U. Toronto)

We have conducted \(^{12}\text{C}O\), \(^{13}\text{C}O\) J=2-1, 1-0 observations of the global molecular gas reservoir in a sample of 20 Seyfert galaxies. Our purpose was to probe the excitation properties of the gas and see whether the enhanced star formation seen in the hosts of type 2 Seyferts has any discernible effect on the molecular gas.

We find type 2 Seyferts to be, on average, ”warmer” than type 1, however a larger sample will be needed in order to improve the statistics. On a more statistically firm ground lies our conclusion that Seyfert galaxies as a class shows a larger affinity to starburst galaxies than to non-starbursts, in terms of their molecular gas excitation.

98.03
The Deep Silicate Absorption Feature in IRAS 08572+3915 and other Infrared Galaxies
C.G. Wynn-Williams, C.C. Dudley (U. Hawaii)

New mid-infrared (10 and 20 \(\mu\)m) spectroscopy of the ultraluminous infrared galaxy IRAS 08572+3915 is presented. The 20 \(\mu\)m spectrum reveals a deep silicate absorption feature, while the 20 \(\mu\)m spectrum shows no clear evidence for an 18 \(\mu\)m silicate absorption feature. An interstellar extinction curve is fitted to IRAS 08572+3915 and two other deep silicate infrared galaxies, NGC 4418 and Arp 220. It is found that pure extinction cannot explain the spectral energy distributions of these sources. On the other hand, both the strength of the silicate absorption and the overall spectral energy distributions of the three galaxies agree well with scaled-up models of galactic protostars. From this agreement, we conclude that the infrared emission comes from an optically thick dust shell surrounding a compact power source. The size of the power source is constrained to be smaller than a few parsecs. We argue that accretion onto a supermassive black hole, rather than a burst of star formation, is more likely to be the power source.

98.04
Mid-Infrared Forbidden Lines In Active Galactic Nuclei: NGC 1068, NGC 4515, and NGC 5506

We display infrared spectroscopy of three Seyfert galaxies. Velocity resolved spectra covering low excitation potential transitions of \([\text{Ar III}] 8.99 \mu\text{m}, [\text{S IV}] 10.54 \mu\text{m}, \text{and [Ne II]} 12.81 \mu\text{m} were obtained using the facility mid-infrared array spectrometer (SpectroCam) of the Palomar Observatory 5 m telescope, and low resolution spectra covering \([\text{Mg V}] 5.16 \mu\text{m}, [\text{Ar II}] 2.99 \mu\text{m}, \text{and [Ne VI]} 12.81 \mu\text{m} were obtained using the faint object spectograph (HIPOGS) of the Kuiper Airborne Observatory.

Our airborne low resolution spectroscopy of NGC 4516 has revealed two new coronal lines of Ne and Mg, and unexpectedly bright \([\text{Ar II}] \text{ emission. Our high resolution ground-based spectroscopy has revealed high contrast [Ar II] and [S IV] in each galaxy, and [Ne II] in NGC 1068 and NGC 4515. The [Ar III], [S IV], and [Ne II] line profiles are highly resolved. In NGC 1068 and NGC 4515, they are fit by single component Gaussians. However, in NGC 5506 evidence for a broad pedestal is seen in the [Ar III] and [S IV] spectra. We find that [Ar III], [S IV], and [Ne II] lines in NGC 1068 exhibit a higher dispersion line broadening than in NGC 4515, and in both galaxies, we find that the highest transition critical density line we observe (S IV) exhibits the narrowest line profile. Comparison of our measured line fluxes to photoionization models of NGC 1068 and NGC 4515 is also presented.

98.05
Physical Conditions of the Coronal Line Region in Seyfert Galaxies
J.Ferguson, K.Korista, G.Ferland (U. Kentucky)

The launch of the Infrared Space Observatory and new atomic data calculations have opened a window to the study of high ionization gas in active galactic nuclei (AGN). We present the results of large grids of photoionization simulations of the “coronal line” region in AGN, employing new atomic data from the Opacity and Iron Projects. Our computations span 8 orders of magnitude in gas density and 14 orders of magnitude in ionizing flux in an effort to identify the optimal conditions in which these line forms. We show that coronal lines form at distances from just outside the broad line region to \(\sim 400L_\odot\) \(\text{pc}\), in gas with ionization parameter \(\sim 2.2\times10^{5} \log(U/H)\), corresponding to gas densities of \(10^2\) to \(10^7 \text{ cm}^{-3}\), with electron temperatures \(\sim 12,000 \text{ K} \sim 150,000 \text{ K}\). A large range of distances from the central source implies significant line width variation among the coronal lines. We identify several line ratios which could be used to measure relative abundances, and we use these to show that the coronal line gas is likely to be dust free.

98.06
Photoionization Models of AGN Disk Winds
N. Murray, J. Chiang (CITA, U. Toronto), J. Chiang (NRL)

One of the defining features of active galactic nuclei (AGN) is the presence of broad emission lines in their optical and ultraviolet spectra. The line wings extend to velocities \(\sim 10^4 \text{ km s}^{-1}\), suggesting that the lines form in gas very close to the central black hole that powers the AGN. We have proposed from the ionization of models that emit. The line wings are single hole electron high luminosity.