

Local Seyfert AGN: Molecular and Ionized Gas within the Central Kiloparsec



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ANCHORAGE

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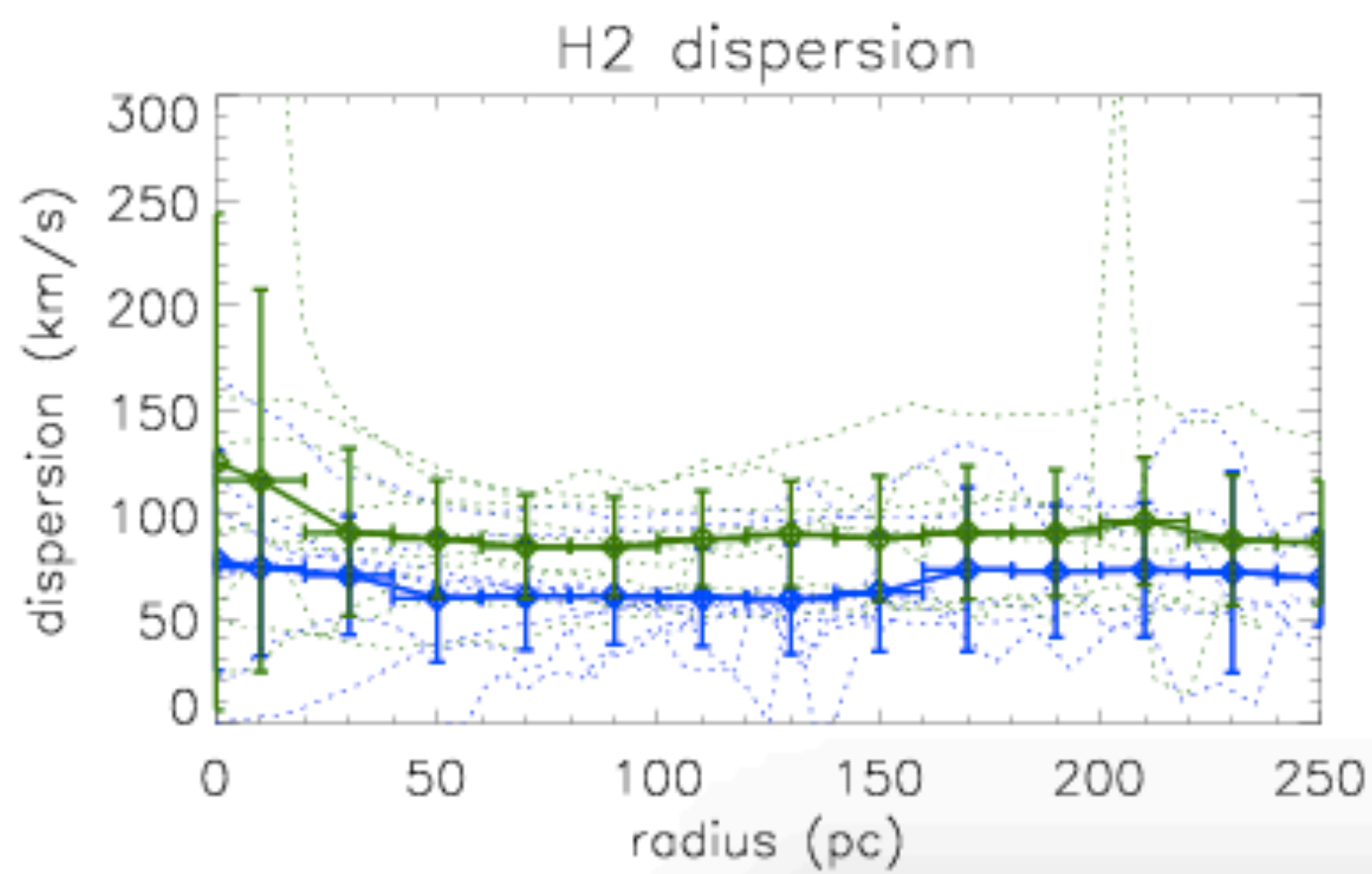
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Abstract

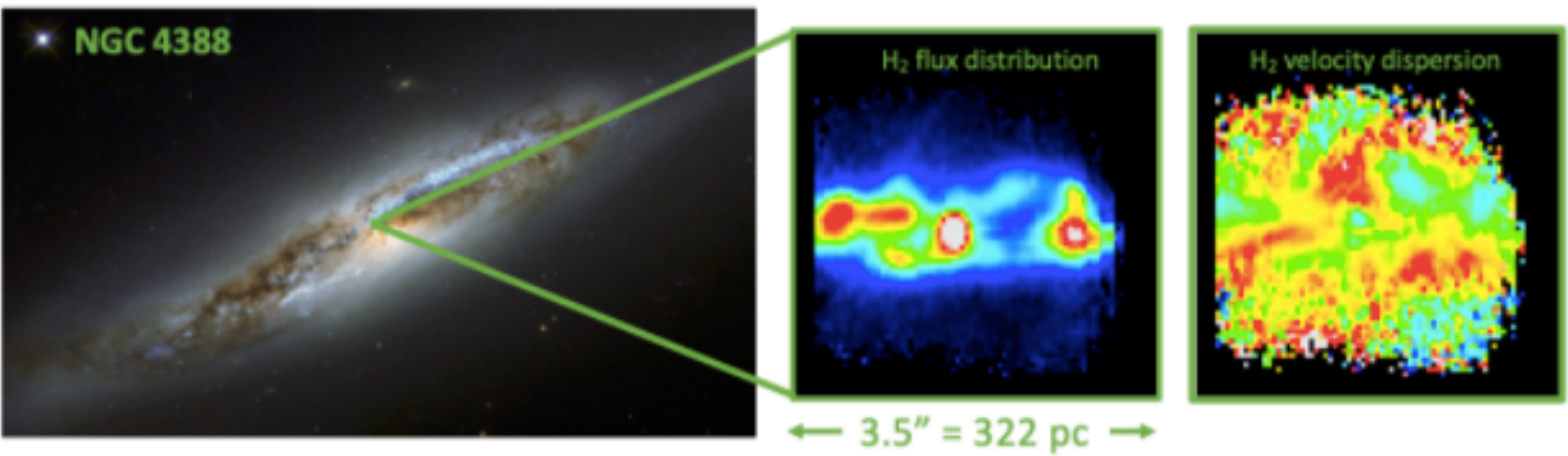
In an effort to robustly characterize the Seyfert circumnuclear region over a meaningful range of AGN and host galaxies properties we are creating a database of all available near-IR integral field observations of local, $z < 0.04$, AGN. Based on an initial compilation of archival K-band observations probing the central kiloparsec down to scales of tens of parsecs, an analysis is presented of the circumnuclear molecular hydrogen, traced by H_2 2.12 micron, and ionized gas, traced by [Si VI] 1.96 micron. In comparison to the warm molecular gas, which is dominated by disk rotation with relatively low velocity dispersion, the ionized gas is more centrally concentrated with higher velocity dispersion suggestive of outflows. In addition, the [Si VI] velocity dispersion tends to be higher in Seyfert type 1s compared to type 2s with no such subsample difference found in the molecular gas component. These circumnuclear properties will be discussed in the context of the over three orders of magnitude AGN hard X-ray and K-band luminosities spanned by the sample. Ultimately the compiled database will consist of approximately 100 local AGN for which the distribution and kinematics of the circumnuclear molecular and ionized gas, as well as stars, are mapped within the central kiloparsec.

Background

The 58 galaxies in this data set and the data collected from them will be used to address the question of whether or not Seyfert Type 1 and Seyfert Type 2 galaxies are fundamentally different types of galaxies or whether the difference of the Seyferts is due to an evolutionary change where the Seyfert type fluctuates over time. This research will help gain headway in understanding how galaxies and their black holes coevolve, something we have come to understand to be a fundamental component of shaping galaxies into what we see today. The question behind the coevolution of black holes and their host galaxies remains a major mystery in modern astrophysics and my research has and will continue to provide insight into answering this question.



This graph shows the azimuthally average velocity dispersion of the molecular hydrogen gas in relation to the central kiloparsec for the 18 galaxies observed with SINFONI on the ESO Very Large Telescope (dashed lines). The subsample average is also shown for Seyfert 1 galaxies (shown in blue) and for Seyfert 2 galaxies (shown in green).



Galaxy NGC 4388 is one of the galaxies in the dataset and shown above to the right are the close-up views of the center of the galaxy and how the gas is distributed through the center of the galaxy.

Data Table

Galaxy	Seyfert Type	HWHM_H2	HWHM_SiVI	HWHM_CO
eso137	Sy 2	129.5	157.25	55.5
mcg0523	Sy 1.9	25.2	16.8	33.6
mcg0630	Sy 1.2	130	48.75	32.5
ngc1365	Sy 1.8		8.7	
ngc1566	Sy 1.5	26	10.4	67.6
ngc2110	Sy 2 (1h)	114.8		24.6
ngc2992	Sy 1.8	95.15	43.25	60.55
ngc3081	Sy 2 (1h)	48.9	27.65	73.35
ngc3783	Sy 1.2	18.3	9.15	
ngc4388	Sy 2 (1h)	12	16.3	30
ngc4593	Sy 1.0-1.2	12.6	12.6	6.3
ngc5506	Sy 2 (1i)	13	13.02	117
ngc5728	Sy 2	40	60	80
ngc6814	Sy 1.5	25	15	30
ngc7172	Sy 2 (1i)		70.65	211.95
ngc7213	Sy 1 (LINER)	20.4	5.1	66.3
ngc7582	Sy 2 (1i)	17.6	13.2	17.6
ngc7496	Sy 2	22	17.1	148.2

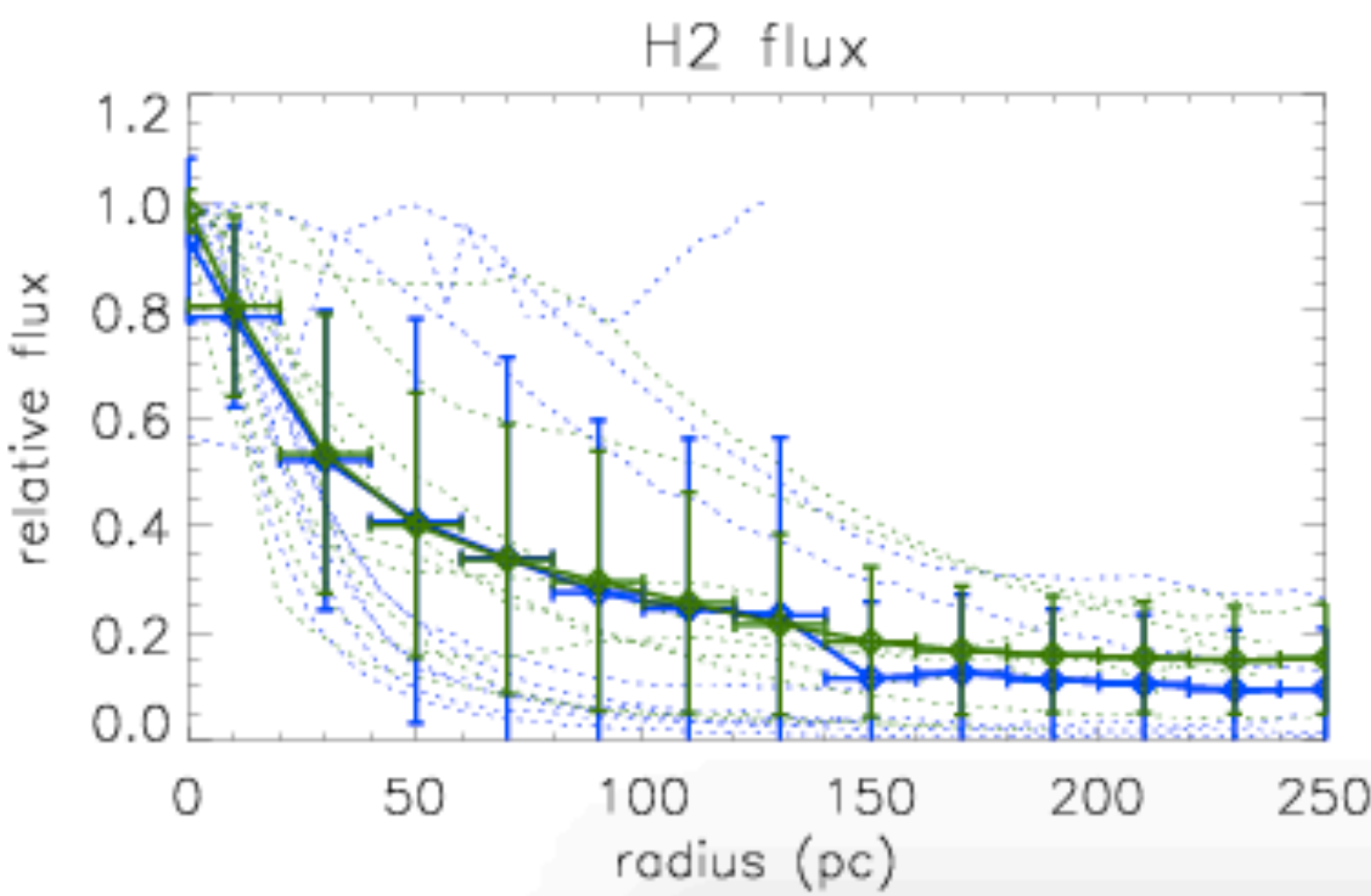
This table of data shows the 18 galaxies from the ESO Very Large Telescope and the measurements of their half width half maximum (HWHM) of the galaxies' luminosity profile, which quantifies the distribution of the gases and how rapidly the distribution decreases from the center of the galaxies.

Methods and Results

.For the Seyfert 1 galaxies the median HWHM for H_2 is 25 parsecs (+/-) 50 parsecs, and for the Seyfert 2 it is 48 parsecs (+/-) 87 parsecs. For SiVI, the Seyfert 1 is 17 parsecs (+/-) 18 parsecs and the Seyfert 2 is 26 parsecs (+/-) 31 parsecs. For the star position, Seyfert 1 is 31 parsecs (+/-) 53 parsecs and the Seyfert 2 is 63 parsecs (+/-) 49 parsecs. The comparison between the Seyfert 1's and 2's for the gases and the star position show that the median of the Seyfert 2 galaxies is greater than the Seyfert 1's, however the standard deviation is large and the difference between the two subpopulation is not statistically significant. The median HWHM of the 58 galaxies for the molecular hydrogen gas (H_2) is 38 parsecs (+/-) 71 parsecs, for the SiVI it is 21 parsecs (+/-) 25 parsecs, and for the star position it is 49 parsecs (+/-) 52 parsecs. This comparison for all the galaxies show that the SiVI median HWHM is smaller than the other two medians, yet the standard deviation is large so the statistical significance is low. We see there is a tendency for SiVI to be more centrally concentrated in comparison to the molecular hydrogen and the stars. The molecular hydrogen and the stars have a similar distribution, which suggest that they are cospatial.

Conclusion

The addition of the 40 galaxies of the extended KONA sample to the 18 galaxies has allowed the analysis to become more statistically sound and with the future addition of more galaxies, the analysis will continue to improve statistically. With these results, we will then use them to explore trends of the different gas phase characteristics with fundamental properties of the AGN and host galaxy, for example AGN luminosity and galaxy type.



This azimuthally averaged flux distribution graph represents where the molecular hydrogen gas is located in the central kiloparsec for the 18 galaxies observed with SINFONI on the ESO Very Large Telescope (dashed lines). The subsample average distribution is also shown for Seyfert 1 galaxies (shown in blue) and for Seyfert 2 galaxies (shown in green).