Nuclear Activity in Galaxies Across Cosmic Time
Proceedings IAU Symposium No. 356, 2019
M. Pović, P. Marziani, J. Masegosa, H. Netzer, S. H. Negu & S. B. Tessema, eds.
doi:10.1017/S1743921320002859

Dirt-cheap gas scaling relations: Using dust attenuation and galaxy radius to predict gas masses for large samples of AGNs

Hassen Yesuf

Kavli Institute for Astronomy and Astrophysics, Peking University, Beijing 100871, China

Abstract. We analyze the molecular and atomic gas data from the GALEX Arecibo SDSS Survey (xGASS) and the extended CO Legacy Database (xCOLD GASS) IRAM survey using novel survival analysis techniques to identify a small number of stellar properties that best correlate with the gas mass. We find that the dust absorption, A_V, and the stellar half-light radius, R50, are likely the two best secondary parameters than improve the Kennicutt - Schmidt type relation between the gas mass and the star formation rate, SFR. We fit multiple regression, taking into account gas mass upper limits, to summarize the median, mean, and the 0.15/0.85 quantile multivariate relationships between the gas mass (atomic or molecular hydrogen), SFR, AV and/or R50. In particular, we find that the A_V of both the stellar continuum and nebular gas emission shows a significant partial correlation with the molecular hydrogen after controlling for the effect of SFR. The partial correlation between the A_V and the atomic gas, however, is weak and their zero-order correlation may be explained by SFR. This is expected since in poorly dust-shielded regions molecular hydrogen is dissociated by the far ultraviolet photons and HI is the dominant phase. Similarly, R50 shows significant partial correlations with both atomic and molecular gas masses. This hints at the importance of environment (e.g., galacto-centric distance) on the gas contents galaxies and on the interplay between gas and star formation rate. We apply the gas scaling relations we found to a large sample of type 2 and type 1 AGNs and infer that the gas mass correlates with AGN luminosity. This correlation is inconsistent with the prediction of AGN feedback models that strong AGNs remove or heat cold gas in their host galaxies.

Keywords. galaxies: active, galaxies: properties, galaxies: star formation