

Plasma diagnostics of emission-line galaxies in SDSS

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Abstract. Sample contains 15 019 narrow emission-line galaxies, i.e. Seyferts, LINERs, composites and star-forming galaxies, from SDSS DR7 for systematically studying differences between different classes. We report two clear sequences of electron temperature (T_e) and density (n_e): $T_{e-LINER} \gtrsim T_{e-composite} > T_{e-Seyfert} > T_{e-star-forming}$ and $n_{e-Seyfert} \gtrsim n_{e-LINER} > n_{e-composite} > n_{e-star-forming}$. General transitions of n_e and T_e from central regions to disks are quantitatively confirmed.

Keywords. galaxies: active, galaxies: ISM, galaxies: Seyfert, galaxies: starburst, surveys

Brief Overview & Quick Results

Our emission-line galaxy sample is selected by requiring $S/N > 5$ in strong emission-lines, and is divided into four classes through applying the galaxy classification scheme from Kewley *et al.* (2006). Plasma diagnostics are obtained through $I[S\ II]\lambda 6716/\lambda 6731$ and $I[O\ III]\lambda 5007/\lambda 4363$ with simultaneous determination for $n_e[S\ II]$ and $T_e[O\ III]$ in 15 019 sampled galaxies. We further identify three groups according to the physical aperture size of SDSS 3-arcsec diameter fibers ϕ (kpc) and $FWHM$ (km s^{-1}) of $H\alpha$ (Bennert *et al.* 2006; Kollatschny & Wang 2006): $FWHM > 300$ for “NLR-dominated” (labeled ND ; $\ln\phi < 1$) and “disk-contaminated NLR” (labeled DC ; $\ln\phi > 1$) objects; $FWHM < 300$ for “non-NLR” objects (labeled NN). Table 1 summarizes our results. By comparing stellar mass, specific star formation rate and plasma diagnostic results, we propose that $Y_L \geq Y_{SF} > Y_C > Y_{SF}$, where Y is the characteristic present-day star-formation time scale. Moreover, in the case of AGNs, we find that several strong lines of evidence suggest some supplementary energy source(s) should be responsible for high ionization potential.

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Table 1. Summary of the mean values of n_e and T_e .

Number	Seyfert			LINER			composite			Star-forming		
	ND	DC	NN	ND	DC	NN	ND	DC	NN	ND	DC	NN
	89	1,052	701	7	75	13	35	348	955	3	165	11,576
n_e [cm^{-3}]	415	332	160	230	201	113	208	150	77	166	152	57
T_e [10^4 K]	1.40	1.32	1.29	2.13	1.37	2.73	1.76	1.68	1.61	1.78	1.77	1.37

Notes. ND : “NLR-dominated” objects; DC : “disk-contaminated NLR” objects; NN : “non-NLR” ones.

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