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Publicly available database for spectral line measurements of SDSS DR7 galaxies

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Abstract. We present a new database of absorption and emission-line measurements based on the Sloan Digital Sky Survey (SDSS) 7th data release of galaxies within a redshift of 0.2. Using the publicly available penalized pixel-fitting (pPXF) and gas and absorption line fitting (gandalf) codes, our work improve the existing measurements for stellar kinematics, the strength of various absorption line features, and the flux and width of the emissions from different species of ionised gas. Most notable of our work is that, we provide quality of the fit to assess reliability of the measurements. The quality assessment can be highly effective for finding new classes of objects. For example, based on the quality assessment around the Ha and [NII] nebular lines, we found approximately 1% of the SDSS spectra which classified as galaxies by the SDSS pipeline are in fact type I Seyfert AGN. This paper presents a summary of the recent paper, Oh *et al.*(2011). The database is publicly available at `http://gem.yonsei.ac.kr/ossy/`.

Keywords. catalogs, galaxies:abundances, galaxies:stellar content, galaxies:statistics

1. Introduction

Spectral lines that reveal various properties of galaxies have been widely used to understand the physical processes of the evolution of galaxies. Absorption features reveal vital information on the galaxy formation and evolution, such as luminosity-weighted ages, metallicities and abundance ratios of early-type galaxies (Davies, Sadler & Peletier 1993; Fisher, Franx & Illingworth 1995; Fisher, Franx & Illingworth 1996; Jorgensen (1999); Kuntschner 2000; Kuntschner *et al.* 2006). Nebular emission lines, on the other hand, indicate the status of nuclear (Baldwin, Phillips & Terlevich 1981; Veilleux & Osterbrock 1987; Kewley *et al.* 2001; Kauffmann *et al.* 2003; Schawinski *et al.* 2007) and star formation activities (Osterbrock & Pogge 1985).

Thanks to the Sloan Digital Sky Survey (SDSS) that established one of the largest and homogeneous database of photometric and spectroscopic data, it is possible to systematically study various types of galaxies with little bias. However, the SDSS pipeline measurements on the absorption line strengths are not corrected for the contamination of nebular emissions. Also, internal extinction is not considered, which leads to inaccurate measurements of nebular emission fluxes. In this work, we present improved absorption and emission line measurements of the seventh data release of SDSS (Abazajian *et al.* 2009) galaxies, as well as providing quality assessments of our fits.

2. Method

To properly measure the strength of stellar kinematics, absorption and nebular emission lines, this work adopted a very similar strategy to that used for the SAURON integral field spectroscopic survey (Emsellem *et al.* 2004; Sarzi *et al.* 2006; Kuntschner *et al.* 2006). First, the stellar kinematics were extracted from direct matching of spectra with a set of stellar templates. In this process, spectral regions that are potentially affected by nebular emission are excluded. Second, the strengths of gaseous kinematics and each emission line were measured by fitting the entire spectrum. Finally, our best model for the nebular emission was subtracted from the SDSS spectrum and the strengths of the stellar absorption lines were measured following the standard line-strength index definitions. We used both theoretical stellar population synthesis models (Bruzual & Charlot 2003) and MILES stellar templates (Sánchez-Blázquez *et al.* 2006). Foreground dust Galactic extinction was treated following (Schlegel, Finkbeiner & Davis 1998). Using Balmer decrement, we considered internal reddening that affects only the nebular spectrum.

3. Fitting Quality Assessment

A novel feature is the provision of a fitting quality assessment. This is key to our measurements because a good quality of an observed spectrum (signal-to-noise ratio, S/N) itself does not guarantee a good fit. The most frequent failures of our fits occur in Broad Line Region (BLR) galaxies. Some of these show extreme broad lines similar to those found in QSOs. In addition, template mismatch and telluric atmospheric features induce low quality fits even when the object has a high S/N . The level of fluctuations in the fit residuals (rN, residual noise) to the expected statistical fluctuations (sN, statistical noise), rN/sN ratio well represents the quality of our fit. In order to avoid various stellar absorption and nebular emission line contaminations, we adopted the 4500-4700Å, 5400-5600Å, 6000-6200 Å, 6800-7000Å wavelength intervals and combined the rN/sN ratio of those continuum regions into a single average, excluding the largest value to avoid a spurious contribution from the partially broken SDSS spectra. The distance of rN/sN from the median distribution expresses the goodness of fits in units of sigma, N_σ.

4. Broad Line Regions

The presence of broadened Hα and Hβ lines frequently causes a mismatch in both the emission lines and the stellar continuum. As a result, highly broadened galaxies appear as an unphysical clump beside star-forming sequence in standard BPT diagrams due to poor fit and corresponding line measurements. After identifying such cases, we properly dealt with the broadened component by giving a broader mask around Balmer lines during the `pPXF` fit (Cappellari & Emsellem 2004) and measured the nebular emission line strengths. The objects turned out to be Seyfert I nuclei. Roughly 0.6% of SDSS galaxies are classified as BLRs. Their Hα line width ranges from ~1,000 to ~5,000Å.

5. [NI] $\lambda\lambda$ 5198,5200 doublet correction for elemental abundances

Mgb and Fe absorption strengths are often used to investigate the formation timescale of galaxies. Mgb index strength, however, can be significantly affected by the presence of [NI] $\lambda\lambda$ 5198,5200 doublet. We measured Mgb absorption line strength considering [NI] $\lambda\lambda$ 5198,5200 doublet. After making sure of morphology by applying FracDeV and concentration index parameters, we explored how [NI] $\lambda\lambda$ 5198,5200 doublet enlarges

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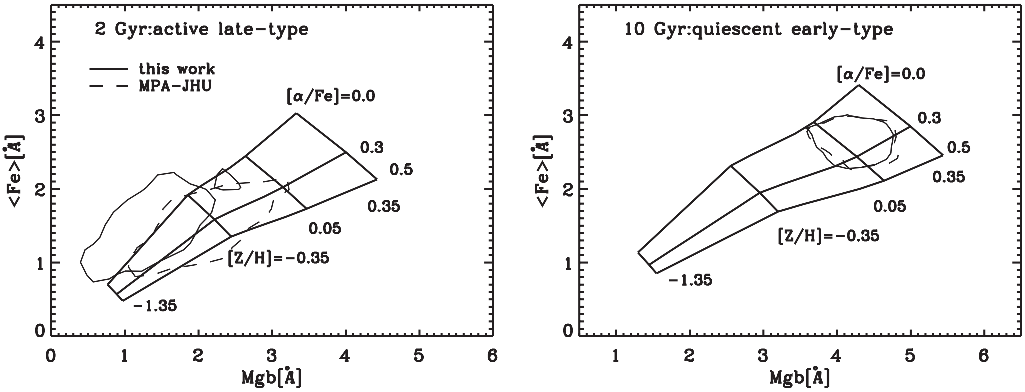

Figure 1. Effect of [NI] $\lambda\lambda$5198,5200 emission correction on Mgb index. The stellar population models(Thomas *et al.* 2003, grids) on [α/Fe] and metallicity spaces for active late-(left) and quiescent early-type galaxies(right) assuming 2 Gyr and 10 Gyr of age, respectively. Contours(solid and dashed) represent 1σ distribution.

Mgb index strength(Goudfrooij & Emsellem 1996). Fig. 1 confirms the importance of the correction of [NI]$\lambda\lambda$5198,5200 doublet on Mgb index passband. Unlike the MPA-JHU catalog, our measurements conclude that only early-type galaxies are α-enhanced.

6. Database

The database (http://gem.yonsei.ac.kr/ossy/) is mainly organized in three parts ; stellar absorption, nebular emission line strengths and fitting quality assessment. All the values are provided in both plain ascii and binary fits formats.

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