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The Nature of Faint Emission-line Galaxies

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One of the results of faint (B > 20) galaxy redshift surveys is the increased fraction of galaxies which have strong emission-line spectra (Broadhurst *et al.*, 1988 (BES); Colless *et al.*, 1990 (LDSS); Cowie *et al.*, 1991; Broadhurst *et al.*, 1992). These faint surveys find that roughly 50% of the galaxies have an equivalent width of [OII], W_{3727}, greater than 20Å while this fraction is less than 20% in the DARS (B < 17) survey. This has been interpreted as evidence for strong evolution in the galaxy population at redshifts less than 0.5 (BES; Broadhurst *et al.*, 1992; Cowie *et al.*, 1992).

In order to further investigate the properties of the galaxies in faint redshift surveys two important factors must be addressed. The first is the observed correlation between color, luminosity, and W_{3727}. There is a correlation between color and the strength of emission-lines, bluer galaxies having stronger emission features, as evident for Markarian galaxies (Huchra, 1977) and for galaxies in Kennicutt's spectrophotometric atlas (Kennicutt, 1992). This correlation also applies to galaxies in faint redshift surveys (see Figure 2) (Koo and Kron, unpublished). In addition, low luminosity galaxies have a larger average W_{3727} (and bluer colors) than higher luminosity galaxies. This is illustrated in Figure 1a for Kennicutt's low z late-type galaxies (Kennicutt, 1992), 1b for the Durham Faint Surveys (BES and LDSS), and 1c for galaxies in SA68 (B < 23).

The second factor which must be incorporated into any interpretation of the faint emission galaxies is the different luminosity functions for galaxies depending on color. This is usually modeled by varying M* for different color classes (or morphological types); however, the **shape** of the luminosity function is different for galaxies with different colors. Low luminosity, blue galaxies have a much larger number density than low luminosity, red galaxies (Shanks, 1990). Furthermore, the low luminosity end of the blue galaxy luminosity function is not well fit by a Schechter function (Shanks, 1990).

These two factors have been included in a very simple, no-evolution, model for the galaxy population. This model uses the luminosity functions from Shanks (1990) and spectral energy distributions (SEDs) from Bruzual (1988). W_{3727} is predicted using the correlation (including dispersion) with color shown in Figure 2. Although this model is very simple, utilizing a small number of SEDs and luminosity functions, preliminary results show that the observed distribution of W_{3727} is reproduced without evolution. For 16 < B < 17 the fraction of galaxies with strong emission-lines is roughly 18% while this fraction is 52% for 20 < B < 21.5 (the range of BES) and 54% for 21.5 < B < 22.5 (the range of LDSS). Unfortunately, this model does not reproduce the observed median redshift of these samples. The model's median redshift is too small by 20% compared to faint redshift surveys. Some of this difference is likely to be due to the small number of SEDs used. The limited success of this model indicates that the differences between the luminosity functions for different classes of galaxies and color-luminosity-W_{3727} effects are important in the interpretation of faint galaxy data. An observational program is currently underway to determine the luminosity function and emission-line characteristics of faint blue galaxies to better precision.

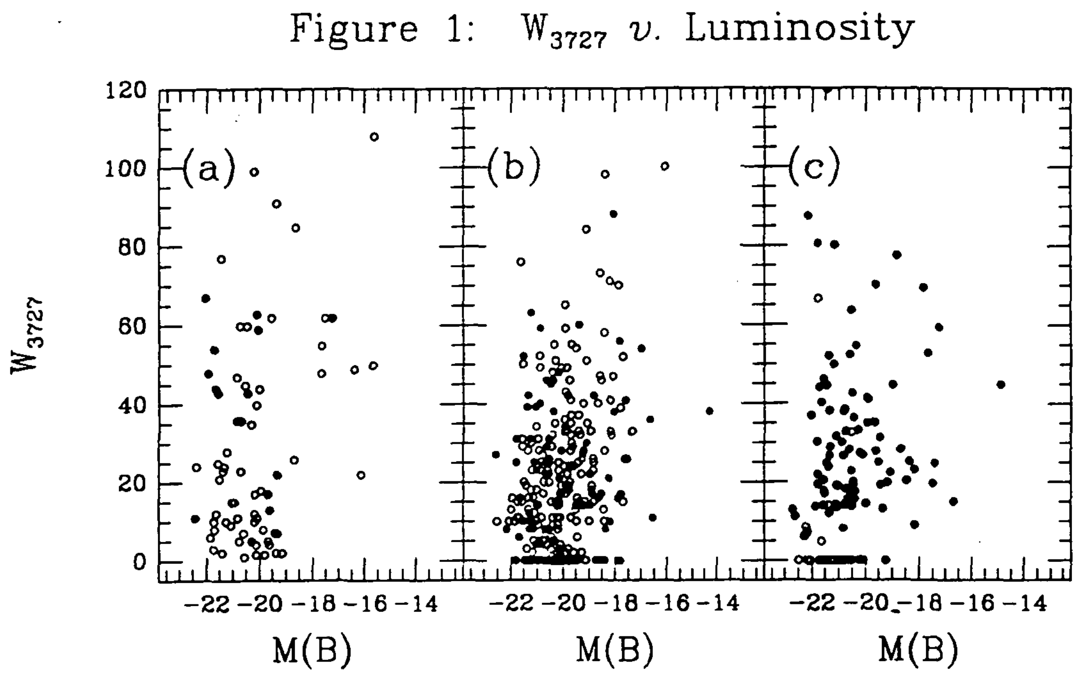
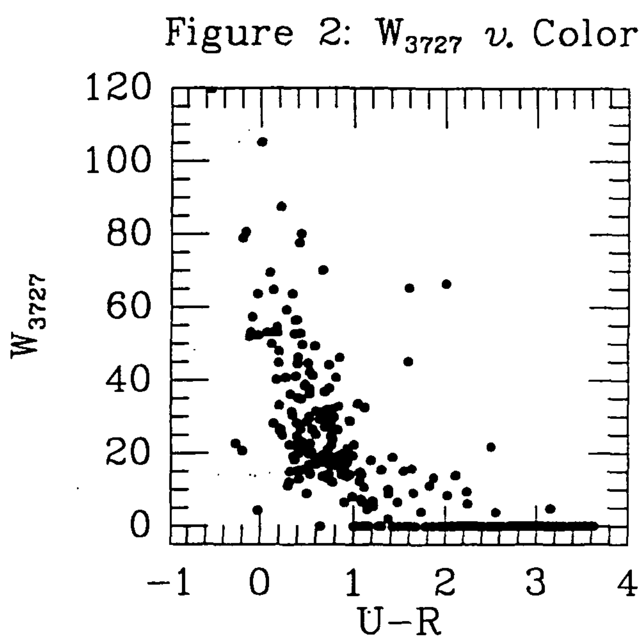


Figure 1: Luminosity *v.* W_{3727} for three galaxy surveys. (a): Late-type galaxies (Sa-I0) from Kennicutt (1992). Solid symbols represent peculiar and/or Markarian galaxies. (b): Galaxies in the DFS. Open symbols represent galaxies from BES. Solid symbols represent galaxies from LDSS. (c): Galaxies in SA68. Solid symbols represent galaxies with U-R < 1.

Figure 2: The correlation between U-R color and W_{3727} for galaxies in SA68. A color-selected (U-R < 1) redshift survey to B < 21.5 which allows increased statistics for blue galaxies is included along with the galaxies observed in the color-independent Koo-Kron redshift survey.



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