

A WISE View of E+A Galaxies: preliminary results

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ABSTRACT

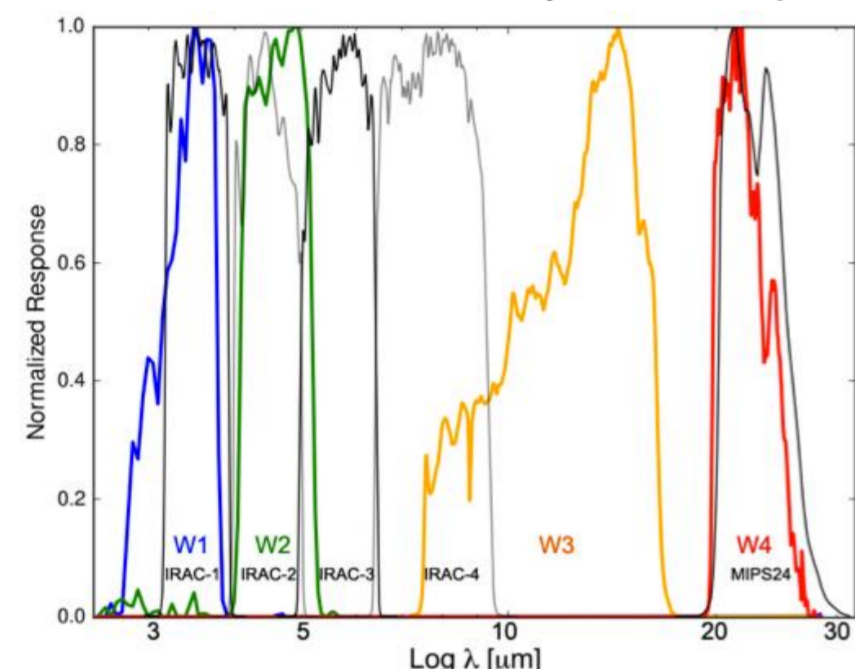
E+A galaxies are interpreted as post-starburst systems because of strong Balmer absorption lines and weak/no emission lines indicating the lack of current star formation activities, thus they are one of key populations for understanding how star formation has started and quenched in galaxies. We present mid-infrared (MIR) properties of E+A galaxies, using the Wide-field Infrared Survey Explorer (WISE) preliminary released data in conjunction with the Korea Institute for Advanced Study Value-Added Galaxy Catalog (KIAS-VAGC) and the MPA-JHU DR7 release of spectrum measurements for the SDSS Data Release 7 (DR7). Furthermore, we investigate the role of environment with respect to the MIR properties of E+A galaxies for the volume-limited sample. We here consider two kinds of environmental factors: a surface galaxy number density estimated from five nearest neighbor galaxies as a large-scale environmental parameter and the distance to the nearest neighbor galaxy as a small-scale environmental parameter.

INTRODUCTION

WISE : NASA's Wide-field Infrared Survey Explorer (Wright et al. 2010)

- 3.4, 4.6, 12, and 22 μm with an angular resolution of 6.1" 6.4" 6.5" & 12.0"
- Preliminary Data Release ~ approximately 23,600 deg² (~57% of the sky)

- The WISE relative system response curves



W1 (3.4 μm ; blue), W2 (4.6 μm ; green), W3 (12 μm ; orange) and W4 (22 μm ; red) are compared to the Spitzer IRAC and MIPS-24 (from Jarrett et al. 2011)

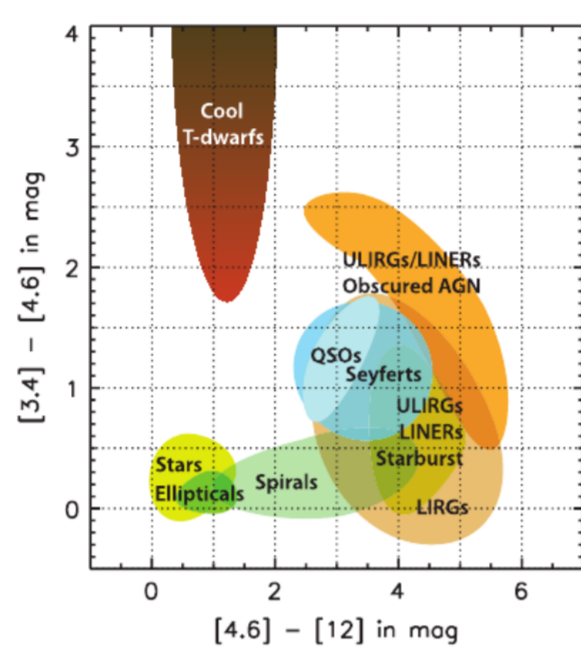
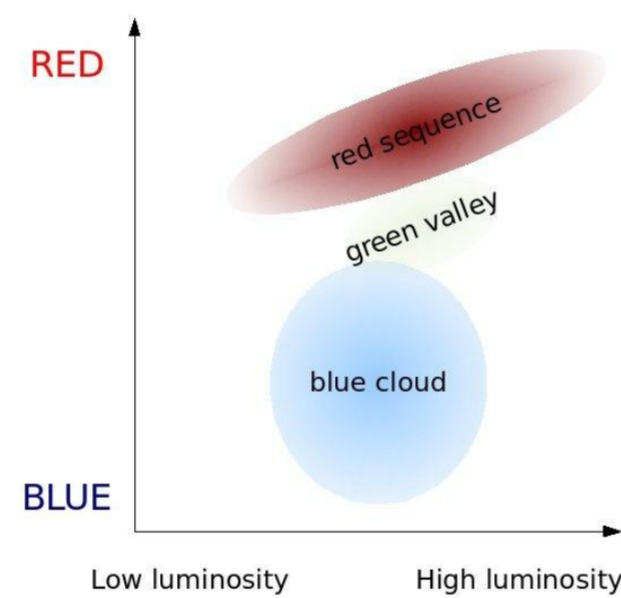
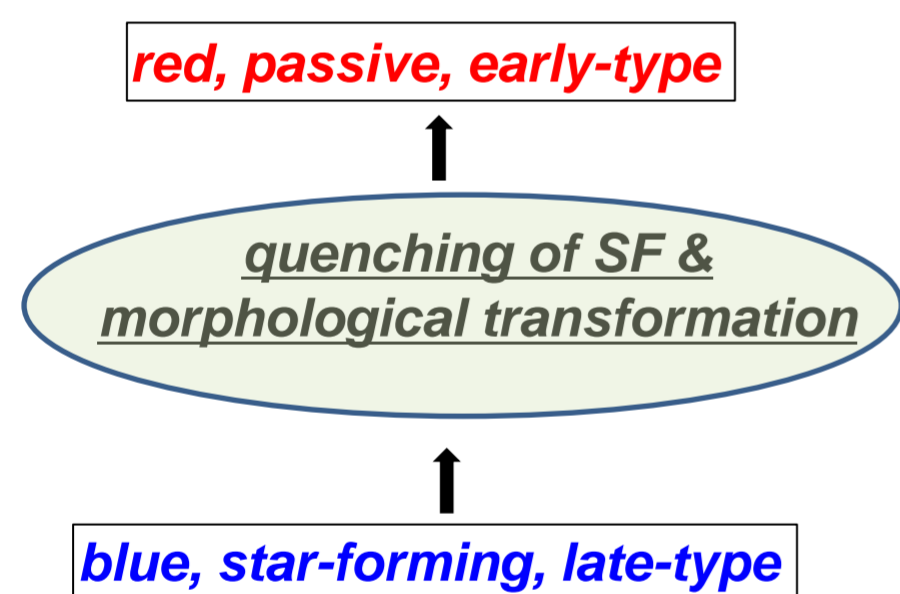


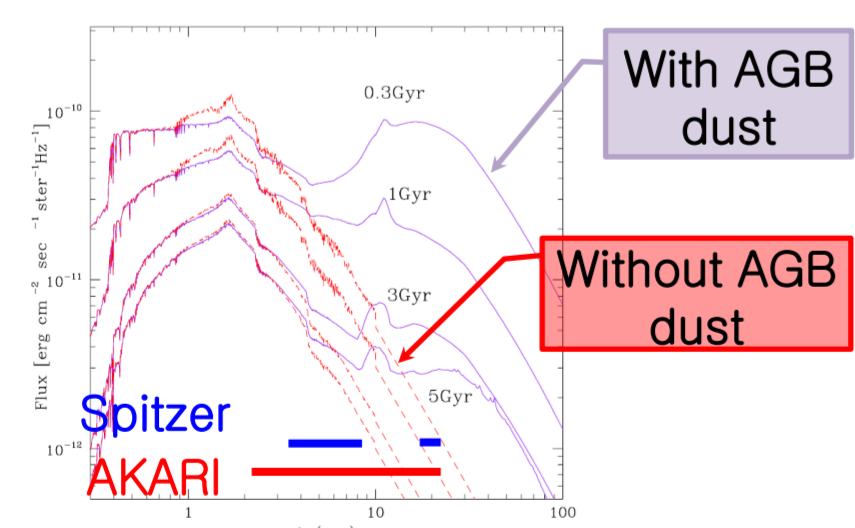
Fig. 12 in Wright et al. (2010): WISE color-color diagram showing the locations of interesting classes of objects.

E+A galaxies : where are they?

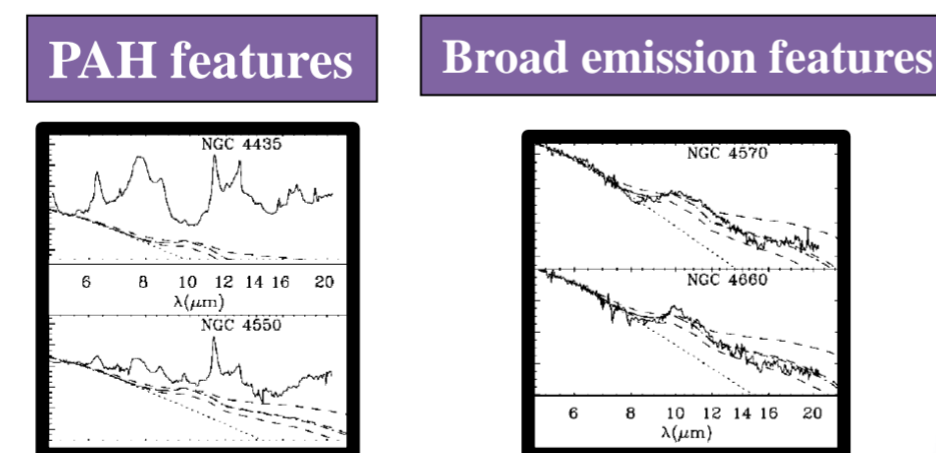


→ A candidate between red and blue populations is the so-called E+A, K+A, or post-starburst galaxies due to their combination of both populations, showing a significant young stellar population (age < 1 Gyr) and a lack of ongoing star formation.

A WISE view of E+A galaxies?



Piovan et al. (2003) model showing mid-IR emission is sensitive to age



Bressan et al. (2006) showing Spitzer IRS spectra of early-type galaxies

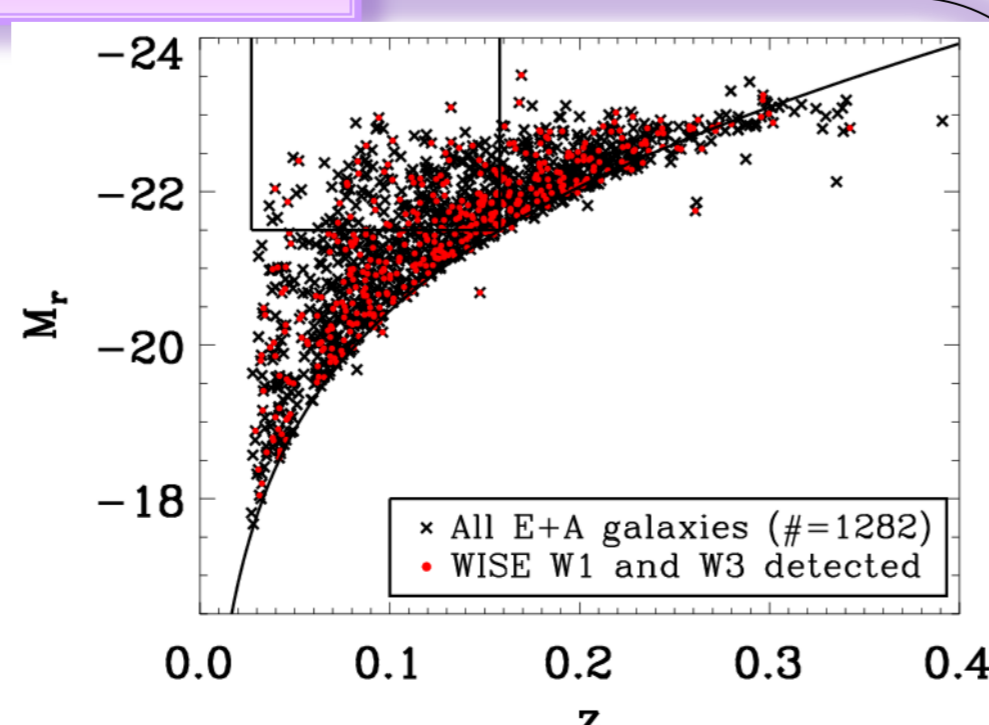
DATA and SAMPLE

SDSS DR7 (KIAS-VAGC + SDSS main sample) + WISE preliminary data release (April 14, 2011)

MPA-JHU DR7 release of spectrum measurements for the SDSS DR7

1282 E+A catalog: from Choi et al. (2009)

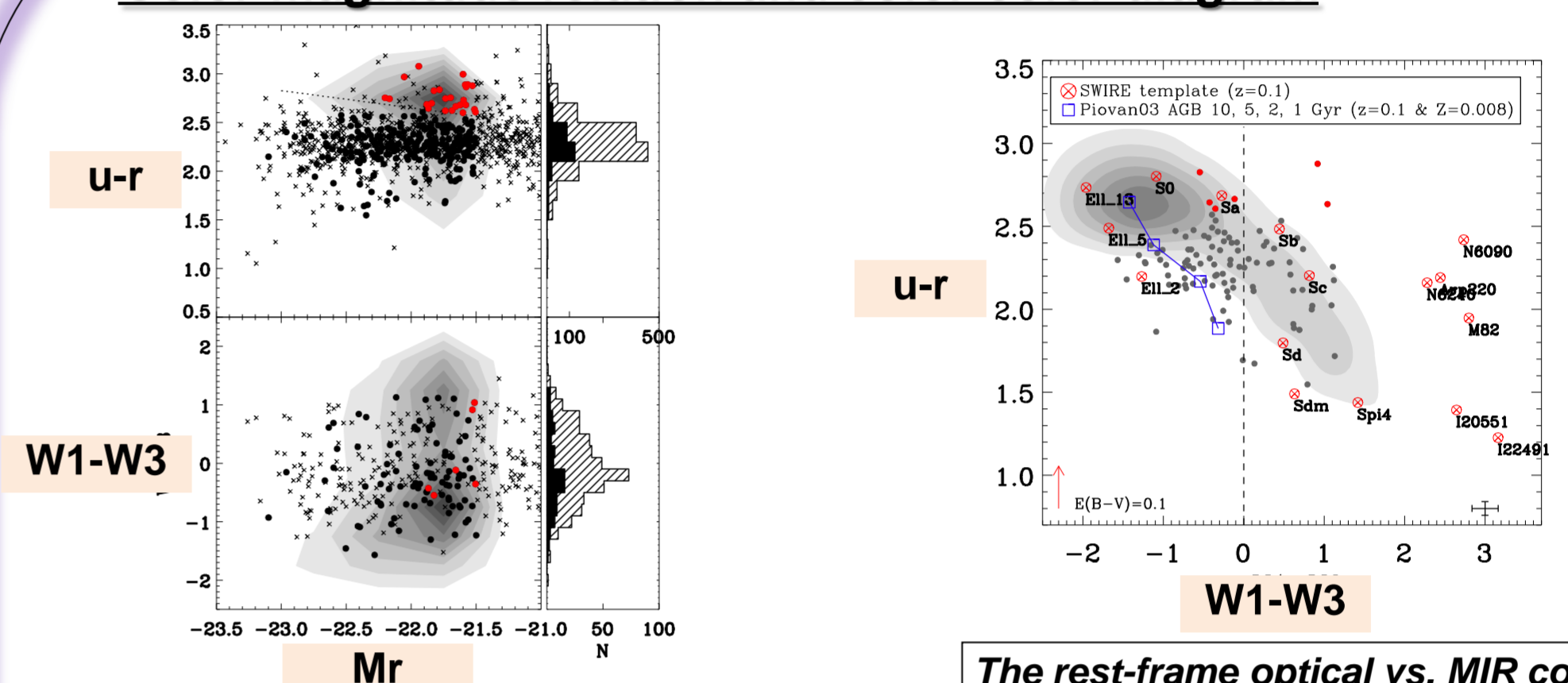
290 E+A volume-limited sample (0.0272 < z < 0.1578 & Mr < -21.5) of 148824 main galaxies



Sample definition of our volume-limited sample in the absolute mag. vs redshift space. The bottom curve corresponds to the apparent mag. limit of $m_r = 17.77$.

RESULTS

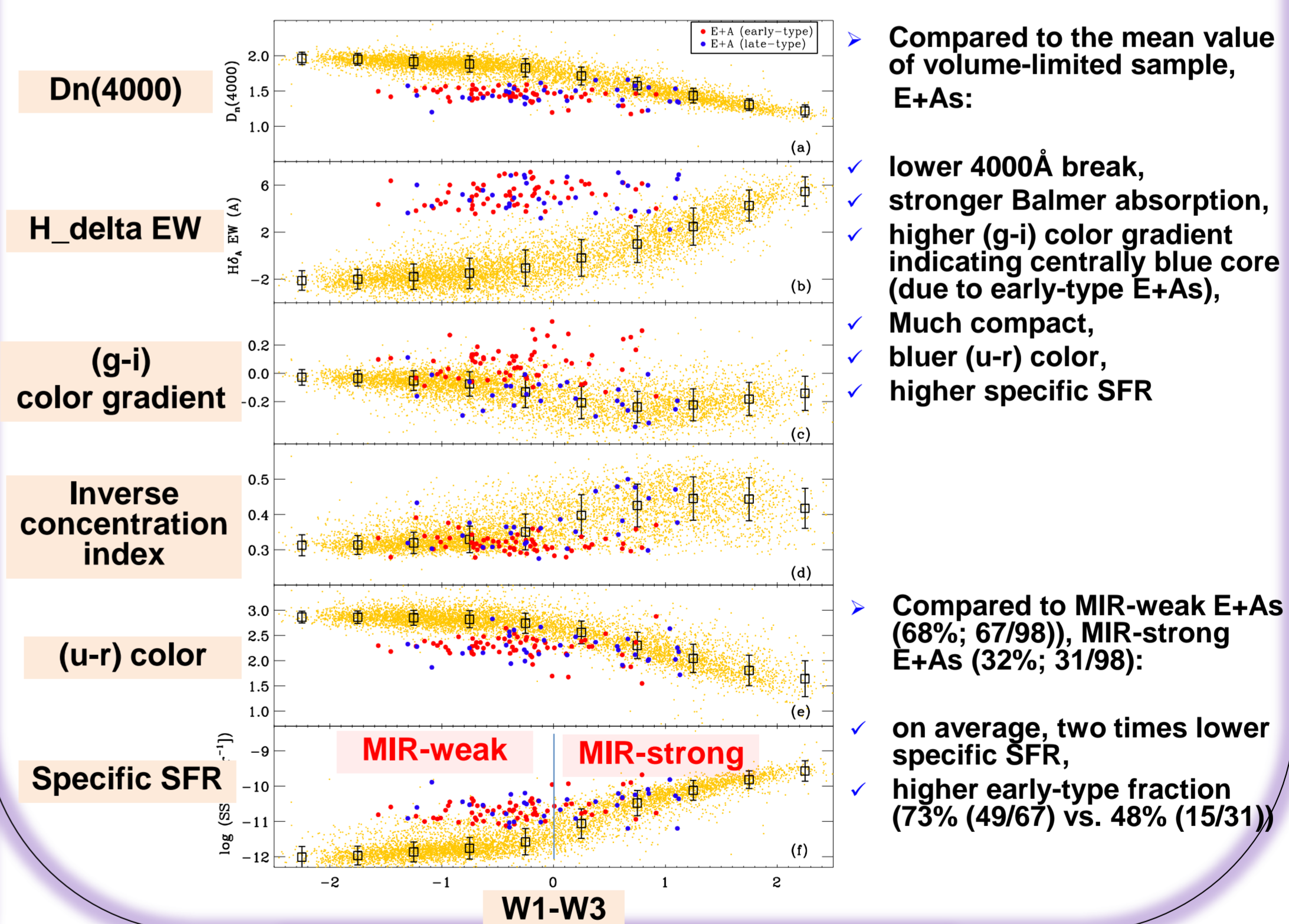
Color-magnitude relation and color-color diagram



Black circle: volume-limited E+As (290), red circle: volume-limited E+As in the red-sequence (25/290), and cross: all E+As (1282) with contours based on the volume-limited sample.

The rest-frame optical vs. MIR color-color distribution of E+As with SWIRE templates of Polletta et al. (2007) including 3 ellipticals (2, 5, 13 Gyr), 7 spirals, and 6 starbursts. Also SSP templates with AGB dust of Piovan et al. (2003) are plotted.

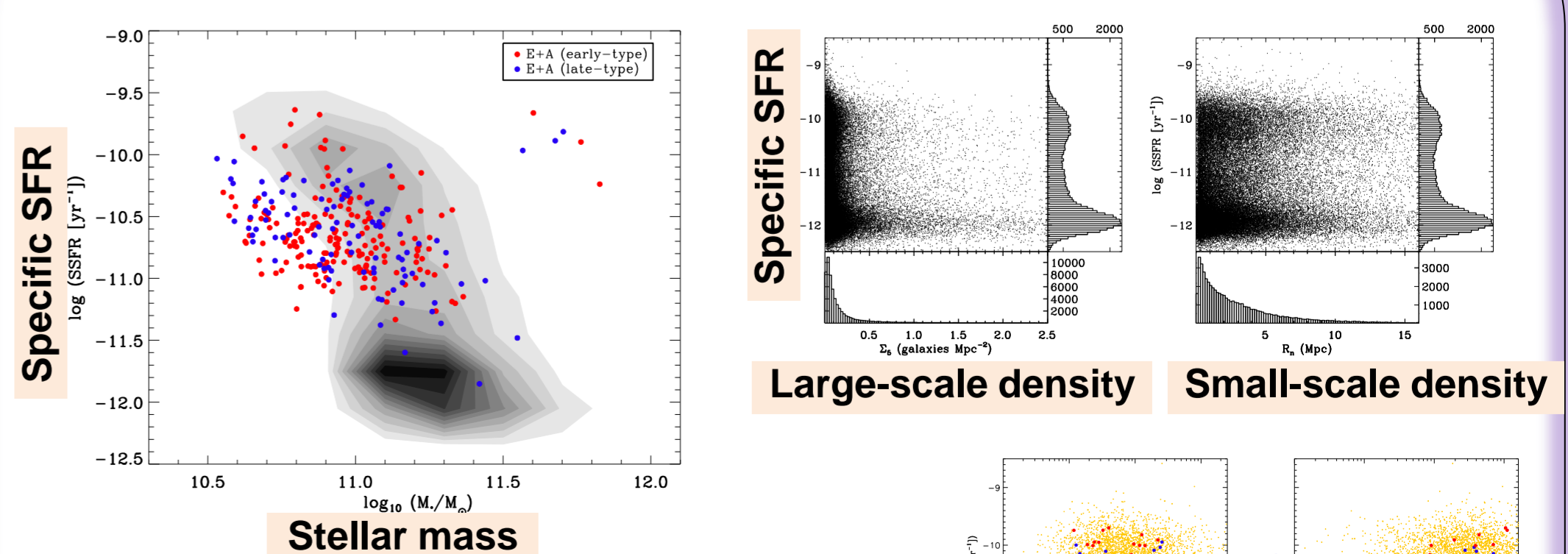
Physical properties of E+As as a function of MIR color



- Compared to the mean value of volume-limited sample, E+As:
 - lower 4000Å break,
 - stronger Balmer absorption,
 - higher (g-i) color gradient indicating centrally blue core (due to early-type E+As),
 - Much compact,
 - bluer (u-r) color,
 - higher specific SFR
- Compared to MIR-weak E+As (68%; 67/98), MIR-strong E+As (32%; 31/98):
 - on average, two times lower specific SFR,
 - higher early-type fraction (73% (49/67) vs. 48% (15/31))

DISCUSSION

Mass and Environment trend of E+A galaxies



→ Among bright ($M_r < -21.5$) local galaxies, E+As are lower stellar mass systems in the lower-density environment, but have a wide range of MIR color, suggesting various dust properties of E+A galaxies