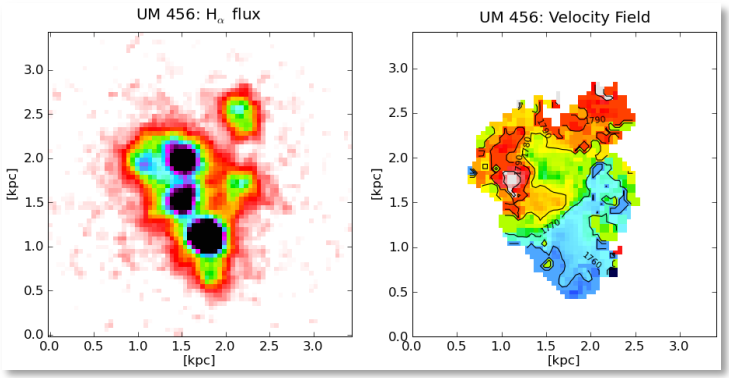
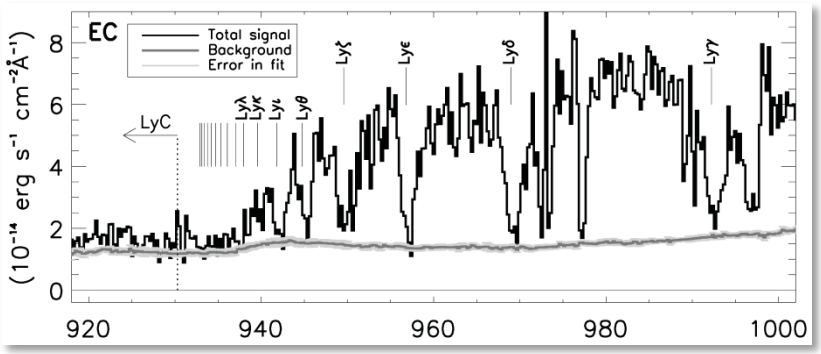
Starburst Dwarf Galaxies

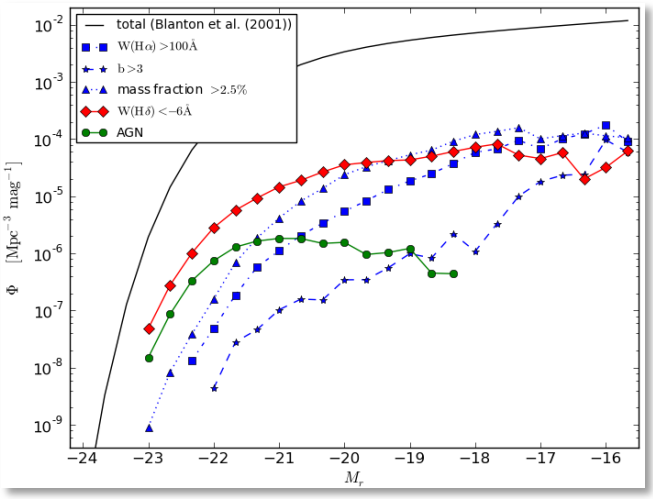
Star forming dwarf galaxies are the most abundant galaxy type in the local universe. They are metal poor and gas rich and can serve as proxies of the fundamental building blocks in galaxy formation scenarios. For a long time the most intense phase of star formation in dwarf galaxies - starbursts - has been the subject of research in the Uppsala galaxy group. Questions we currently work on include: Are starbursts induced by galaxy mergers and can this be seen in the galaxies' internal kinematics? How much can dwarf galaxies contribute to cosmic reionization? How important are starbursts for galaxy evolution and how do they relate to other galaxy types?



We have used a Fabry-Perot spectrograph to obtain spatially resolved spectra of the Hα emission line in 40 dwarf starburst galaxies. This allows us to measure the internal motions of the interstellar medium and derive line-of-sight velocity maps like the one in the right-hand panel. We found that the galaxy UM456 (left) does not orderly rotate as would be expected from a non-interacting gas rich galaxy. The velocities and the width of the emission allows to derive dynamical masses from photometry and compare them with the models of stellar populations.

Haro 11 is a luminous starburst dwarf galaxy with a star formation rate enhanced by at least a factor 10, producing myriads of super star clusters. On the right we show a spectrum from FUSE in the UV region with marked Lyman absorption lines. The background has been modeled by us in detail and is shown in grey. The spectrum shows a weak excess in the Lyman continuum (marked with an arrow), revealing leaking ionizing radiation. This is the only example of leakage from a dwarf galaxy in the local universe. It gives support to the idea that starburst dwarf galaxies are the main drivers of the cosmic reionization.





Using data from the SDSS we have modeled the spectra of some 30000 galaxies that were selected for their current (strong Hα emission) or recent (strong Hα absorption from short-lived A-type stars) star formation. From the derived ages and masses, we can directly compare the statistics of the most intense starburts (that contribute significantly to the stellar mass build-up) with their inevitable postburst remnants. Figure on the left shows the luminosity function for different selections of galaxies. The starbursts (blue) and postburst (red) are only a fraction of the total contribution of galaxies (black line). While the number of starbursts agrees well with the corresponding postbursts at the low-mass end of the luminosity function, there is a significant discrepancy at higher masses, probably due to the influence of active galactic nuclei (AGN, green) that often light up together with star forming activity. Also noteworthy is that the galaxies with a birthrate parameter b (current star formation divided by averaged star formation over the galaxy's history) larger than 3 (star symbols) makes for a differently shaped luminosity function than the rest. This is due to the fact that the gas consumption timescale is shorter for big galaxies, resulting in shorter post-bursts.

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