Refining the E+A Galaxy: A Spatially Resolved Spectral Analysis & Synthesis of Nearby Post-Starburst Systems in SDSS-IV MaNGA (MPL-5)

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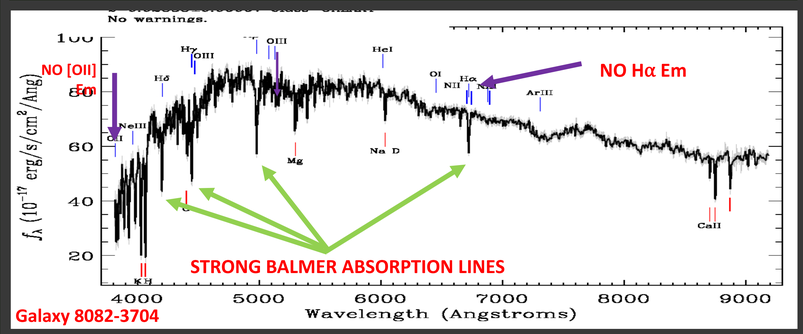
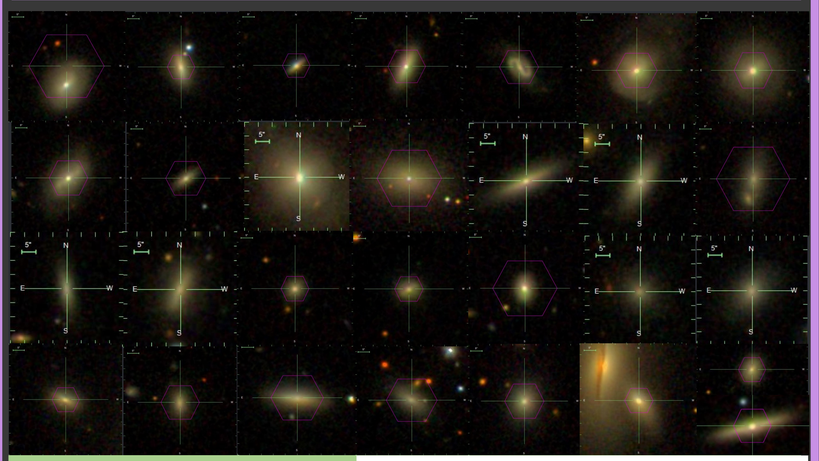
FISK-VANDERBILT Master's-to-Ph.D. BRIDGE PROGRAM

E+A traditionally defined by a single fiber spectrum

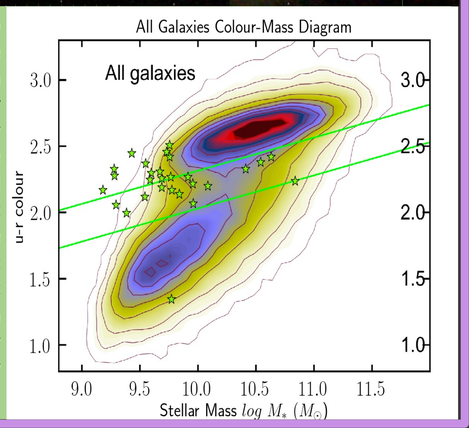


E+A galaxies are post-starburst systems, approximately 1 Gyrs of age, that have suddenly quenched all star formation. The spectra of these galaxies are shaped like those of an elliptical, but begin a negative slope in the 5000Å range; meaning the colour of an E+A galaxy is going to be more golden than red. E+As are defined by this optical spectra, which specifically shows a combination of an old stellar population, a very well developed Balmer/Dn4000 break, and very strong Balmer Absorptions lines. This work is to show a new, improved way of refining the definition of an E+A galaxy, by IFS methods through MaNGA. Through this survey, we have been able to 100% classify the entirety of the galaxy, and not just the single-fiber region as before, eliminating many previous candidates.

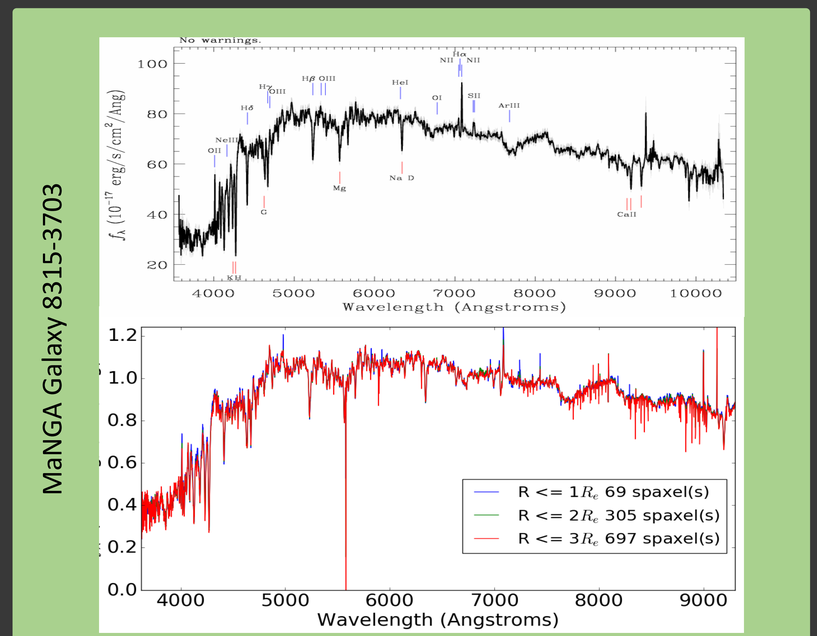
COLOUR & THE GREEN VALLEY



This rare type of galaxy is thought to be a transitory phase from the blue cloud to the red sequence, lying in the Green Valley of the u-r colour mass relation, a diagram created by Schawinski et al, 2014. The above image is all 29 galaxies from our final sample, while the image to the right is that sample plotted over the above mentioned diagram, denoting that while some of our galaxies do not sit in the "prime" green valley region directly between the BC and RS, they still reside in the green valley contours surrounding those regions.

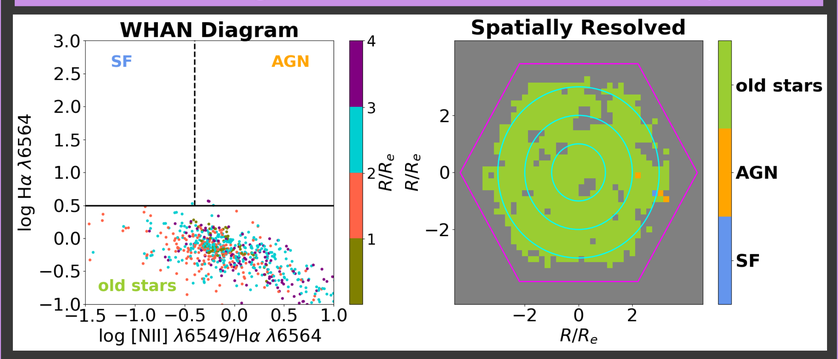


Our technique: IFUs to find pure E+A galaxies



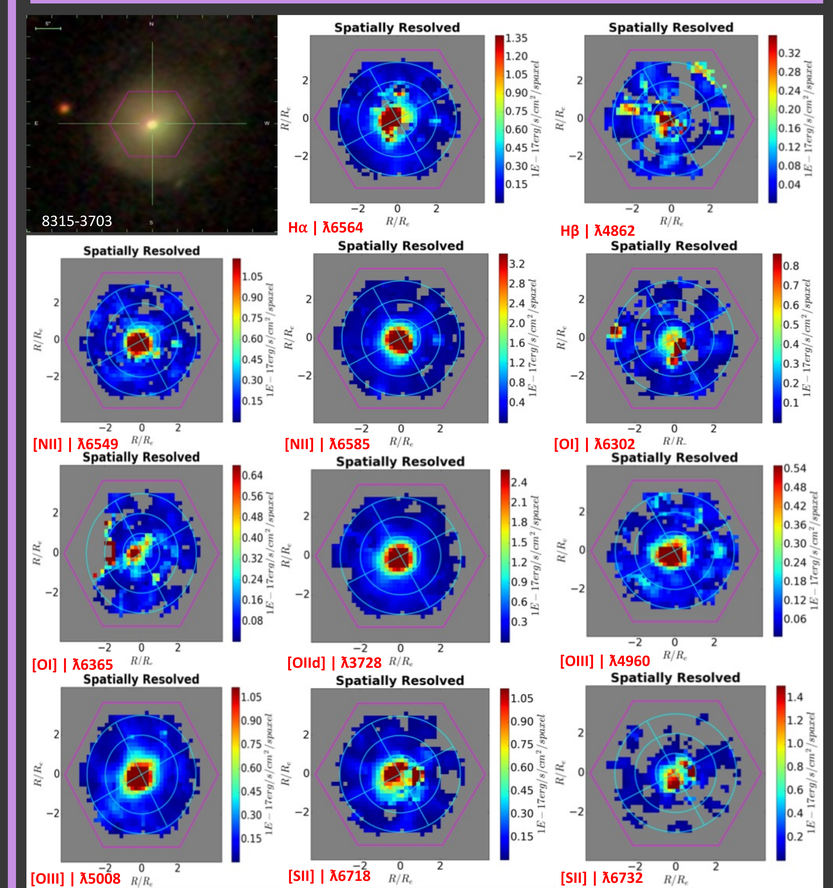
We averaged the spectra of each spaxel within 3 annuli on each galaxy at 1-3 effective radii from the center. As another clarification step, we collected the spectrum from each of these regions and plotted them against each other and the original SDSS single-fiber, to **determine if the galaxy was E+A in its entirety, and not only in the single-fiber region.**

Line ratio diagnostics: our E+As are uniformly old



Following the approach of Belfiore et al, 2015, we created WHAN diagrams to delineate how much of our galaxy was classified as "old stars" due to specific ionization rates; meaning the EW(Hα) < 3Å. Our galaxies averaged a little more that 90% of their spaxels in this region. This was the main method by which we were able to eliminate many previous single-fiber candidates.

MaNGA'S IFU MAPS



Using the IFS of SDSS-IV MaNGA, we are able to look at each candidate E+A system across the entire galaxy out to at least 1.5 R_e. This allows us to confirm that the galaxy has E+A properties well beyond the central regions, and to measure the metallicity & age of its stellar populations as a function of distance from the galaxy center. Our restrictive selection criteria allows us to confirm that any nuclear line emission in these E+As are caused by weak AGN, and not centrally concentrated star formation. For us, this will be key in how the stellar pops of these galaxies develop, and what that implies about assembly & the quenching processes in galaxy evolution.

REFERENCES & ACKNOWLEDGEMENTS

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Zibetti et al, 2012
Meusinger et al, 2016
Goto et al, 2005 & 2007
Dressler & Gunn, 1983
Schawinski et al, 2014
Belfiore et al, 2015