Three-Dimensional Spectroscopy and Star Formation Histories of Field E+A Galaxies

Charles T. Liu¹, Marsha Wolf², Eric J. Hooper² and Joshua Bather³

¹Astrophysical Observatory, Dept. of Eng. Science and Physics, City Univ. of New York, College of Staten Island, 2800 Victory Blvd, Staten Island, NY 10314 USA
²Dept. of Astronomy, Univ. of Wisconsin, 475 N. Charter Street, Madison, WI 53706-1582 USA
³School of Physics and Astronomy, Univ. of St. Andrews, North Haugh, KY16 9SS Scotland

email: charles.liu@csi.cuny.edu, cliu@amnh.org

Abstract. We present the initial results of an integral field spectroscopic survey of E+A galaxies in the field, which combined with radio continuum measurements and multi-wavelength photometry and imaging provides significant insight into the dynamical and star formation histories of these transitioning post-starburst systems. We focus on the E+A galaxy known as G515 (z = 0.088), a massive merger remnant that began its star formation quenching process ∼1.0 Gyr ago. Its relatively young stellar population contrasts with its light profile and kinematics, which are more consistent with a slowly-rotating, early-type galaxy.

Keywords. galaxies: starburst and post-starburst - galaxies: evolution - galaxies: formation

E+A (i.e., post-starburst or ‘k+a’) galaxies represent some of the best examples of a system whose star formation is on the verge of being quenched. Thus, they can be valuable signposts of an important but poorly understood process of galaxy evolution. We present the first results of integral field spectroscopy and radio continuum measurements of a sample of E+A galaxies in the field with redshift 0 < z < 0.2, with the goal of examining the properties of this significant evolutionary phase. We focus particularly on J152426.55+080907 at z = 0.088, also known as ‘G515’ or ‘Flagellan,’ for which more than 20 years of spectroscopic data are available (Liu et al. 2007). On several-kpc scales, its optical light is dominated by stellar populations varying in age from 0.5 to 1 Gyr. Optical line emission, particularly in [OII], also appears to be highly variable in both intensity and spatial location. We also see substantial evidence of outflows; and multi-epoch radio observations show weak and significantly variable radio continuum emission, possibly indicative of an AGN nearing the end of its duty cycle. On the other hand, 3-D spectroscopy of G515 obtained with the Sparsepak and Hexpak IFUs at the WIYN telescope at Kitt Peak show that its light profile and kinematics are more typical of a “slow rotator” early-type galaxy. This is perhaps surprising, given its recent merger activity and observed levels of subsequent evolution.

Our results indicate that E+A galaxies apparently do not always fade gradually from “star-forming” to “quenched” states. Rather, they may cease their activity unevenly, in fits and starts, evolving rapidly over very short timescales.

We gratefully acknowledge support of this work from NSF grants AST-1004583 to the City University of New York and AST-10004591 to the American Museum of Natural History, and from the Office of Academic Affairs at the College of Staten Island.

Reference