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Resolved Stellar Populations Constituting Extended UV Disks (XUV-disks) in Nearby Galaxies

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Abstract. We describe HST imaging of recent star formation complexes located in the extended UV disk (XUV-disk) component of NGC 5236 (M 83), NGC 5055 (M 63), and NGC 2090. Photometry in four FUV–visible bands permits us to constrain the type of resolved stars and effective age of clusters, in addition to extinction. The preliminary results given herein focus on CMD analysis and clustering properties in this unique star-forming environment.

1. Overview and Preliminary Results

A decade ago, deep Hα observations indicated that some disk galaxies can support limited star formation at their extreme outer edge (e.g. Ferguson et al. 1998). GALEX imaging then surprisingly revealed that M 83 (Thilker et al. 2005) and NGC 4625 (Gil de Paz et al. 2005) have extended UV disks (XUV-disks) unapparent in the distribution of HII regions. We have since demonstrated that outer disk SF activity is commonplace, with $\sim 1/3$ of nearby S0-Sm galaxies having discernible XUV-disk structure (Thilker et al. 2007). For detailed information, see the review by Gil de Paz (this volume) or Thilker et al. (2007).

The relative lack of HII regions compared to UV clumps in the low SFR outer disk has been largely explained as a stochastic effect, tied to the very limited HII region lifetime compared to the time-scale for UV production (Boissier

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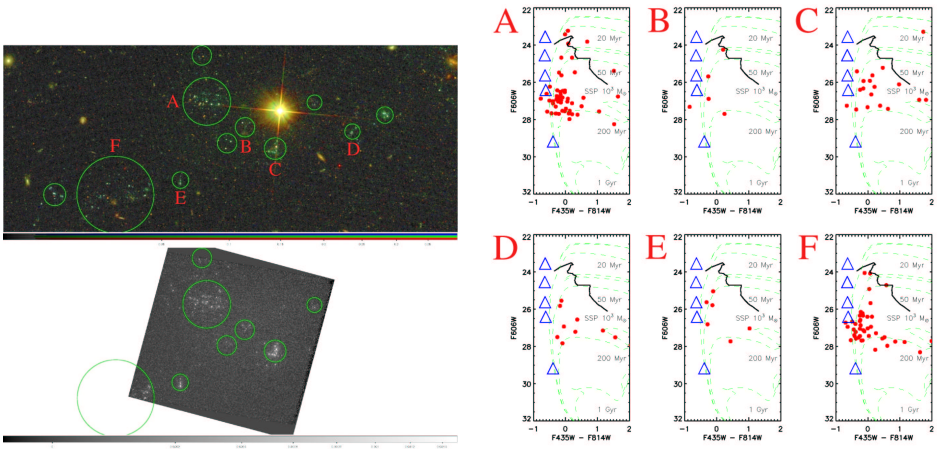

Figure 1. (Left) HST imaging of NGC 5055's XUV-disk. F814W, F606W, and F435W bands are shown above in RGB repesentation, while the lower panel displays UV emission. We mark several SF complexes with circles. (Right) Foreground ext.-corrected CMDs for six of the circled complexes. We show the ZAMS position for stars of 5, 15, 20, 30, and 40 $M_\odot$ (blue triangles). Dashed green lines are Padova isochrones for populations of age 20, 50, 200 Myr and 1 Gyr. The thick black line shows the evolution of an SSP burst totaling 10^3 $M_\odot$ from 5 Myr to 1 Gyr.

et al. 2007). However, alternative contributing factors (top-light IMF, low density ISM) have yet to be ruled out and motivate our HST analysis.

HST ACS UV–visible imaging of eight XUV-disk fields was obtained for M83. Single locations in each of NGC 5055 (Fig. 1) and NGC 2090 are also being studied. We observed in four band-passes (F150LP, F435W, F606W, and F814W) using the WFC and SBC. Optical observations of NGC 2090 were obtained using WFPC2 (after the failure of ACS/WFC).

HST resolves the XUV-disk sources into loosely clustered complexes of individual stars. These complexes, likely evolved OB associations, are low mass ($< 10^3$ $M_\odot$), intermediate age structures. Only very few HST detections are consistent with being zero-age upper-MS stars having mass > 15 $M_\odot$ (Fig. 1). Hα emission is detected from complexes in which they are found. Observed association sizes vary from 100 pc to $\sim$ 500 pc with significant internal subclustering. The largest groupings may be blended associations. CMDs (Fig. 1) suggest multiple generations within larger complexes (up to age of $\sim$ 200 Myr).

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