**Methodology: Dendrogram Analysis and Photometric Measurements**

We employed a modified version of the Python program astrodendro, adapted to output flux values in counts per pixel. The dendrogram algorithm constructs a hierarchical tree by identifying flux peaks as the origins of leaves, checking subsequent pixels against the defined parameters—minimum flux for structure size and flux difference (delta flux) from the local maxima. If a pixel meets the criteria, it merges into an existing structure; otherwise, it initiates a new leaf. When adjacent structures connect at a lower-flux pixel, they merge into a branch, forming a nested hierarchy. The process continues until a designated minimum flux value, or “trunk,” is reached, at which point the dendrogram concludes.

**Parameter Selection for Dendrogram Analysis**

We determined that optimal parameters for the astrodendro program were a minimum flux threshold and delta flux of 3.58x10-18 erg sec-1 cm-1 per pixel, and a minimum range of 100 pixels for structure size. Testing lower pixel thresholds introduced significant noise, with diffuse structures and background interference causing numerous small, unintelligible regions due to FITS file artifacts from data subtraction. Conversely, higher pixel thresholds did not yield sufficient detail within the interior regions. These parameters maximized precision while preserving meaningful substructure identification.

*Insert Figure: Dendrogram tree of NGC 3741, with labeled leaves and branches.*

*Insert Table: DS9 FITS file with Astrodendro contour map overlay for high surface brightness region.*

**Rationale for Separating Analysis of High and Low Surface Brightness Areas**

To improve accuracy, we analyzed high and low surface brightness areas of the H II region separately. Isolating low brightness areas minimized background noise and artifacts from data reduction, improving flux measurements. Additionally, high surface brightness areas primarily reflect Hα emission from star formation, with ionization from young stars while lower brightness areas likely result from supernova-driven shock ionization, producing a diffuse emission profile. Separating these regions allowed us to account for these differing processes. This division enabled more accurate substructure detection within the high brightness areas using astrodendro, while single-aperture photometry was able to effectively quantify the flux in the extended, diffuse regions.

**Supplementary Low Surface Brightness Analysis**

The dendrogram analysis was limited to the main interior structure down to a minimum flux of 3.58x10-18 erg sec-1 cm-1 per pixel, as astrodendro performs best on bright, continuous flux groupings, which were more prevalent within the interior structure. In contrast, low surface brightness areas tended to merge into a single contour, masking distinct structures. Therefore, we manually selected 16 spatially distinct, diffuse regions in DS9 with fluxes between 3.58x10-18 erg sec-1 cm-1 and 1.43x10-17 erg sec-1 cm-1 per pixel, capturing a comprehensive view of both high and low surface brightness components in the H II regions.

**Completeness Limit and Luminosity Function Analysis**

To account for observational limitations, we established a completeness limit of approximately 36.5 erg s−1cm−2 (log space) as a threshold below which faint H II regions remain undetected. This limit allowed us to correct for under-sampling of low-luminosity sources and ensure an accurate representation in the luminosity function.

**Luminosity Function Analysis and Power-Law Fitting**

To derive the luminosity function, we selected bin widths that balanced statistical significance with sufficient resolution, ensuring each bin contained enough data points to support a meaningful power-law fit while preserving the shape of the luminosity distribution. Following Van Zee et al. (2000), we experimented with varying bin widths and confirmed the stability of the power-law index across these configurations to ensure robustness in the fit.

We then modeled the luminosity function of the H II regions as a power law, consistent with previous studies on similar galaxies (Van Zee et al. 2000). The function N(L)=ALαdL, where N(L) represents the number of H II regions with luminosity L, α is the power-law index, and dL is the bin size, allowed us to characterize the luminosity distribution and gain insight into the clustering and star formation activity within NGC 3741.

**Results**

Our analysis yielded a luminosity function with a power-law index of −1.53 +/- 0.17, consistent with values reported for dwarf irregular galaxies (Youngblood & Hunter 1999; Elmegreen & Salzer 1999; Van Zee et al. 2000).

Comparison of the total Hα flux with the summed flux from interior H II regions reveals a slightly different distribution from prior studies. While previous research suggests that roughly 50% of ionized gas resides within H II regions, we measured an interior flux of 2.61x10-13 erg sec-1 cm-1 and an exterior flux of 7.95x10-14 Erg sec-1 cm-1, resulting in a total integrated flux of 3.41x10-13 Erg sec-1 cm-1. This indicates that approximately 76.6% of the ionized gas in NGC 3741 is concentrated within the H II regions, with 23.4% in diffuse exterior areas. This higher concentration may reflect differences in data resolution, completeness limits, or intrinsic properties specific to NGC 3741.

*Insert Figure: Plot of the luminosity function with power-law fit, indicating completeness limit.*