A Massive Star Odyssey, from Main Sequence to Supernova
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The chaotic ISM of the post(?)-starburst galaxy NGC 1569

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Abstract. We present the results and analysis of *HST*-WFPC2 imagery of the starburst galaxy NGC 1569 ($d = 2.2$ Mpc), which permit unprecedented resolution ($\sim$1pc) of the ionized gas and stellar population. The primary data in our analysis consists of images taken through narrow-band filters isolating Hβ, Hα, [O III]λ5007, and [S II]$\lambda\lambda$6717+30, as part of GO Program 8133. A variety of color-coded and grey-scaled maps of the morphology, ionization structure, and dust distribution are presented. Unsharp masks of the Hα images show a very chaotic structure for the ionized gas, with numerous filaments and arc-like bright rim features across the entire galaxy, but without significant large-scale ionization variations. Variations in the ionization and line-of-sight reddening occur on smaller scales ($\sim$ 10 - 50 pc), with numerous low-ionization semi-stellar knots seen throughout the main body of the galaxy, even within the 'hole' in the ionized gas distribution around the central super star clusters previously noted from H I maps. Several of these features have strong [S II] emission indicative of being supernova remnants. We combine these data with archival wide-band *HST*-WFPC2 imagery to quantitatively evaluate the source(s) of the (largely photo-) ionized gas.

1. Introduction – the imagery data

HST observations of NGC 1569 were obtained in 1999 September using WFPC2 with the narrow-band filters F469N, F487N, F502N, F656N, F673N, and F547M in order to study the morphology and physical properties of the emission nebulae in this starburst galaxy. Our poster presents some of the results of our investigation based on colorized maps of the spatial distribution of the ionized gas, its ionization structure, and line-of-sight reddening. A discussion of Wolf-Rayet stars and other He II sources based on our data has been given by Buckalew *et al.* 2000. This short summary is limited to presenting one example of our results[1].

[1]For the full color poster and discussion, see `http://galaxy.rice.edu/~rjd/iau212rjd.jpg`

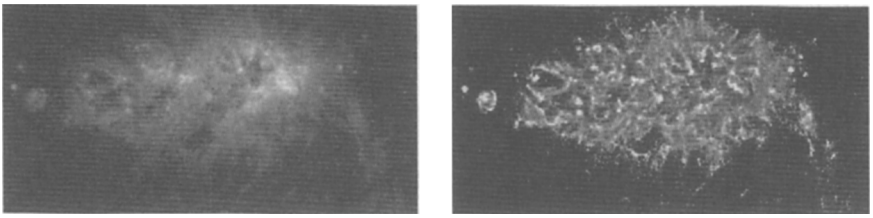

Figure 1. NGC 1569: grey-scale images of the continuum-subtracted Hα surface brightness *(left)* and structural inhomogeneities revealed by unsharp masking *(right)*. The field size is $148'' \times 75''$ across, which corresponds to 1600×800 pc for an adopted distance of 2.2 Mpc. North is 25° counterclockwise from upward with east to the left. The Hα image has been log-scaled between 2.6×10^{-17} and 8.2×10^{-14} ergs cm^{-2} arcsec^{-2}.

2. Illustration of the chaotic structure of the NGC 1569 ISM

Our colorized images and ratio maps show that the ISM of NGC 1569 is very complex in the morphology of the ionized gas, but remarkably smooth in its ionization structure and local extinction. The complex morphology is illustrated in Figure 1 using the technique of unsharp masking of our Hα image. The Hα image vividly illustrates the structural details of the central cavity, or 'hole', in the gas distribution noted previously by Israel & van Driel (1990) from 21cm H I maps. Inside this cavity are two of the three most prominent super star clusters of the galaxy. In the outer parts of the galaxy, numerous filaments are apparent, predominantly oriented radially away from the central star clusters. The unsharp masked image emphasizes sharp structural features throughout the ionized gas component of the galaxy, in the form of numerous bright rims and arcs. In particular, note that the bright rims near the center super star clusters preferentially face toward the center, while bright edges in more distant portions of the galaxy, such as the NW edge, are often oriented away from the galaxy. We interpret this to be due to photoionization fronts on the surface of H I clouds in the inner portions of the galaxy, while more distant regions are possibly excited by outflow processes. Finally, note that the circular emission region at the NE edge of the image exhibits a bright perimeter, suggestive of a 70 pc diameter classical superbubble, similar to others seen in irregular galaxies such as the LMC and NGC 6822. Lastly, we discovered a prominant SNR based on the [S II] images (*cf.* the full poster URL for details).

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References

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