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High-Mass Star Formation in the Far Outer Galaxy

W. Armentrout[1], L. Anderson[2], D. Frayer[1], D. Balser[3], T. Bania[4], T. Dame[5], T. Wenger[6]

[1]Green Bank Observatory, Green Bank, WV, [2]West Virginia University, Morgantown, WV, [3]National Radio Astronomy Observatory, Charlottesville, VA, [4]Boston University, Boston, MA, [5]Harvard Smithsonian Center for Astrophysics, Cambridge, MA, [6]Dominion Radio Astrophysical Observatory, Penticton, BC, Canada

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HII regions are the archetypical tracers of high-mass star formation. Because of their high luminosities, they can be seen across the entire Galactic disk from mid-infrared to radio wavelengths. A uniformly sensitive survey of Galactic HII regions across the disk would allow us to constrain the properties of Galactic structure and star formation. We have cataloged over 8000 HII regions and candidates in the WISE Catalog of Galactic HII Regions (astro.phys.wvu.edu/wise), but only 2000 of these are confirmed HII regions. The work is ongoing, but from our survey completeness limits and population synthesis modeling, we predict there are nearly 10,000 HII regions in the Milky Way created by a central star of type B2 or earlier. A population of especially interesting HII regions trace the Outer Scutum-Centaurus spiral arm (OSC), the most distant molecular spiral arm in the Milky Way. These regions represent star formation at low densities and low metallicities, similar to the conditions in galaxies like the Large Magellanic Cloud or a much younger Milky Way. To date, we have detected high-mass star formation at 17 locations in the OSC, with the most distant source at 23.5 kpc from the Sun and 17 kpc from the Galactic Center. They have molecular cloud masses up to 10^5 M_{sol} and central stellar types as early as O4. By comparing molecular and stellar masses, we can begin to put constraints on the star formation efficiency of these distant outer Galaxy sources. We map the ionized gas using the Very Large Array at X-band in the D-configuration. We map the ^{13}CO, HCN, and HCO+ molecular gas emission using the Argus array on the Green Bank Telescope, producing individual 5 arcmin maps with 8 arcsec resolution and 0.5 K sensitivity in 20 minutes.