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Milky Way Structure Revealed by Galactic HII Regions

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Despite decades of effort, the morphological structure of the Milky Way remains hidden behind dust extinction, small number statistics, and complicated datasets. HII regions, the volumes of ionized gas surrounding recently-formed massive stars, are a classic tracer of spiral arms in galaxies. Over the past decade, the HII Region Discovery Surveys have nearly tripled the number of known Galactic HII regions. With the new Galaxy-wide flux-limited sample of Milky Way HII regions, we are poised to revolutionize our understanding of spiral structure across the Galactic disk. Traditional methods of fitting Galactic structure models to the three-dimensional positions of these nebulae are impossible, however, since most Galactic HII regions lack accurate distance determinations. We are developing a novel machine learning approach that uses simulation based inference to fit complex models of Galactic structure to the complicated position-position-velocity HII region dataset, thereby removing the need for accurate distances. Using simulated observations, we demonstrate the efficacy of this new technique and its potential to reveal the structure of spiral arms across the Milky Way.