Bulletin of the AAS • Vol. 56, Issue 2 (AAS243 Abstracts)

Metallicity Structure in the Milky Way Disk

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Published on: Feb 07, 2024

URL: https://baas.aas.org/pub/2024n2i107p02

Metallicity structure provides a critical constraint on the formation history and subsequent chemical evolution of the Milky Way. In thermal equilibrium the abundance of the coolants (O, N, and other heavy elements) in the ionized gas regulates the electron temperature, with high abundances producing low temperatures. Here we attempt to better calibrate this relationship between the plasma electron temperature, Te, and O/H by observing [OIII] (52 and 88 μm), [NIII] (57 μm), and [NII] (122 μm) toward 9 HII regions with the Herschel telescope. We derive Te in HII regions with radio recombination lines (RRLs) and use them as proxies for the nebular O/H abundances. We derive ionic abundance ratios in the well studied HII region W3A to test our calibration and analysis procedures. We find that the O/H abundance ratio varies by a factor of 5 across W3A with uncertainties that are as large as 50%, inconsistent with previous results. We suspect that the standard calibration procedures employed by Herschel, which assume the source is uniform, explains the large O/H variations in W3A.