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Helium ionization in diffuse ionized regions near the Galactic plane: A case study toward Cygnus X region

**D. Anish Rosh¹ Julian Ramos² Pooja Priyatharsheni³ Phil Perillat¹
Mayra Lebron Santos⁴ Christopher Salter¹ Kimberly Emig⁵
Pedro Salas⁶ Nimma Elizabeth³ Alexander Tielens⁷ Luigi Tibaldo⁸
Isabelle Grenier⁹ Glenn White¹⁰ Matteo Luisi¹¹ Rebecca Levy¹²
Alberto Bolatto¹³ Loren Anderson¹⁴ Stefanie Walch¹⁵**

¹Arecibo Observatory, ²University of Puerto Rico, ³Lady Doak College,

⁴Universidad de Puerto Rico - Río Piedras, ⁵National Radio Astronomy Observatory,

⁶Green Bank Observatory, ⁷Leiden Observatory, ⁸Centre National de la Recherche Scientifique,

⁹Université Paris Cité, ¹⁰The Open University, ¹¹Westminster College, ¹²University of Arizona,

¹³University of Maryland, College Park, ¹⁴West Virginia University, ¹⁵University of Cologne

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Previous low frequency radio recombination line surveys of the Galactic plane have revealed the presence of diffuse ionized regions (DIRs) with electron densities less than a few tens of cm^{-3} . The ratio of the ionized helium to hydrogen in the DIR is known to be < 0.013 (Heiles et al. 1996, Roshi et al. 2012). The observed low value for this ratio severely constrains the spectrum of the sources ionizing the DIR. If OB stars are the primary ionization sources of the DIR, then this ratio would be close to that of the actual He/H abundance ratio of ~ 0.1 . So far, no other plausible source of ionization has been identified. Further there is no satisfactory explanation for the modification of the ionizing spectrum of OB stars to account for the low helium ionization. Thus, the ionization of DIR remains an open question.

As part of a wider study of the DIRs in the Galactic plane, a $6^\circ \times 6^\circ$ region (center G80.0+1.4) in the direction of Cygnus X was surveyed using the Green Bank Telescope at 0.33, 0.8 and 5 GHz. The Cygnus X region is a nearby active star forming region, consisting of tens of OB stars, compact HII regions and DIRs. In this poster, we present results of the analysis of hydrogen and helium RRLs observed toward the Cygnus X region and discuss constraints on the DIR properties and its ionization.