30 Years of Photodissociation Regions:
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REVIEW TALK

Extragalactic PDRs: The Influence of LyC Production Rates and their Escape Fractions on the ISM and IGM

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Photodissociation regions (PDRs) are important structures for regulating star formation and controlling the transition from atomic to molecular interstellar gas. I will discuss PDR structural dependence on metallicity, gas density, and the intensity of the ionizing ultraviolet background (UVB) in the Milky Way and external galaxies. The intensity of the metagalactic UVB is critical to understanding both the interstellar medium (ISM) and intergalactic medium (IGM) and depends on both QSOs and star-forming galaxies. An increase in the UVB by factors of 2–5 may be required (Kollmeier et al. 2014; Shull et al. 2015) to explain the observed distribution of H I column densities in the Lyα forest (Danforth et al. 2014) compared to cosmological simulations of baryon structure formation. The LyC production rates from OB associations depend on stellar metallicity and rotation and the initial mass function. Topping & Shull (2015) coupled non-LTE model atmospheres to recent evolutionary tracks (Ekström et al. 2012; Georgy et al. 2013). They found a median LyC production efficiency $Q_{\rm LyC} = (6 \pm 2) \times 10^{60}$ LyC photons per $M_\odot$ of star formation, equivalent to a rate calibration of $10^{53.3 \pm 0.2}$ photons s^{-1} per $M_\odot$ yr^{-1}, a 50% increase over previous estimates. Despite the importance of massive stars for cosmological reionization at $z \approx 7$, their LyC rates remain uncertain, as are reliable estimates for the escape fraction $(f_{\rm esc})$ of Lyman continuum (LyC) radiation from star forming regions. The spatial structure of PDRs, the evolution of their gas dynamics, and their H I opacity may be key parameters in controlling LyC leakage from the ISM surrounding OB associations.

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