COSMOLOGICAL HII REGIONS

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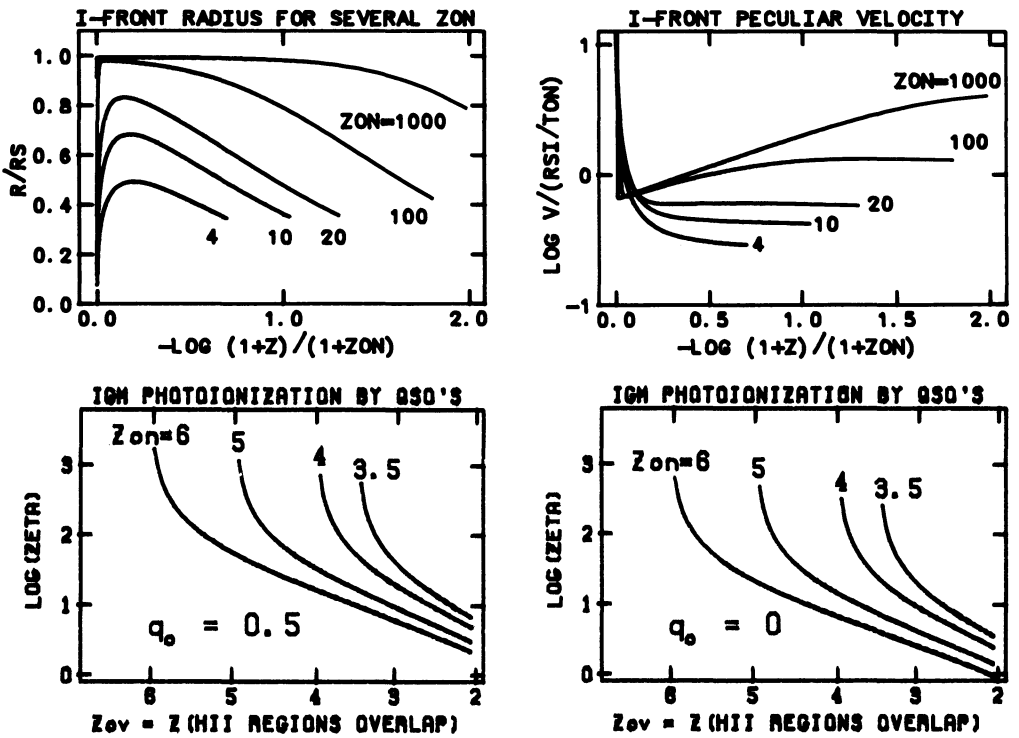
We have generalized the classical description of ionization front propagation to the case of a point source in a uniform, cosmologically expanding gas. We present illustrative curves for the comoving radius and peculiar velocity for several turn-on redshifts, z_{ON}, for $\Omega_{tot} = 1$, $\Omega_b = 0.1$, h = 1. The quantity RS is the generalized Strömgren radius [$RS = RS_i\ (1 + z_{ON})/(1 + z)$, $RS_i = (3N_u/4\pi n_{H,i}^2\ \alpha_2)^{1/3}$, N_u = photoionizing number flux per source, α_2 = recombination rate to n = 2, $n_{H,i} = n_H^\circ\ (1 + z_{ON})^3$]. The quantity $T_{ON} = 2(1 + z_{ON})^{-3/2}/(3H_o)$. We also plot ζ, the value of $(2n_Q^\circ N_{ph,Q}/3H_o n_H^\circ)$ needed to ionize the IGM with overlapping QSO HII regions by redshift z_{OV} for QSO turn-on at various z_{ON}, where $N_{ph,Q}$ = ionizing photon luminosity per QSO, n_Q° = QSO number density (present co-moving value), n_H = H density of IGM, and $n_H/n_H^\circ = n_Q/n_Q^\circ = (1 + z)^3$. From a recent preprint by Koo (1985), we estimate $\zeta \lesssim 1$ (for $\Omega_b = 0.1$, h = 1) for QSO's with $L \sim 10^{45}$ erg s^{-1}. In this case, the observed QSO's cannot be the sole source of the IGM ionization that is implied by the null detection of the Gunn-Peterson effect for QSO's with z > 2.



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