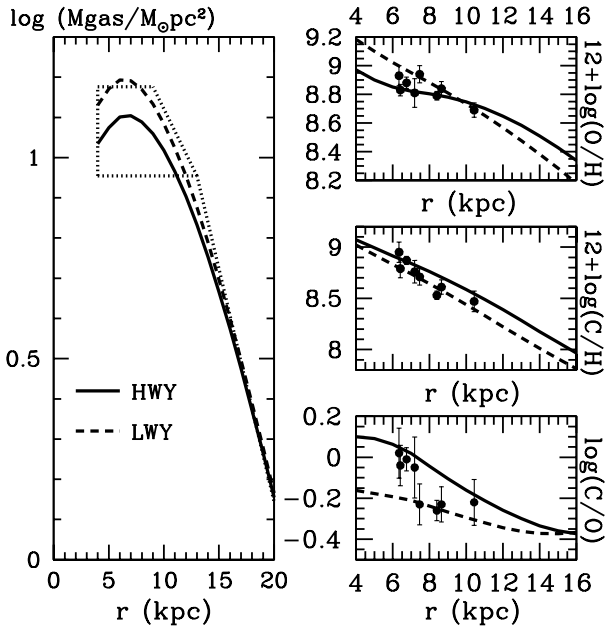

Fig. 1. Present-day radial distribution of: gas surface mass density (left panel), and ISM abundance ratios (right panels). Predictions of our chemical evolution models for the Galactic disk at the present time: HWY (continuous lines), LWY (dashed lines). Observational data: *area enclosed by dotted lines*: average gas surface density distribution by Kalberla & Kerp (2009), *filled circles*: H II regions, gas (García-Rojas & Esteban 2007) plus dust values (see text).

the Galactic bulge obtained by Bensby et al. (2010b) and Zoccali et al. (2008).

The symbols C, O, X, Y, and Z represent carbon, oxygen, hydrogen, helium, and heavy element abundances by unit mass respectively; while C/H, O/H, Fe/H, C/O, C/Fe, and O/Fe represent the abundance ratios by number.

In § 2 we discuss the general properties of the chemical evolution models. We consider infall models for the Galaxy with two sets of stellar yields, the HWY and the LWY. In § 3 we show the prediction of the current abundance gradients for the interstellar medium (ISM) of the Galactic disk and compare them with Galactic H II region abundances derived from recombination lines that include the dust correction. In addition we present for the solar vicinity the chemical history of the ISM and compare it with the chemical abundances of stars of different ages; we define the solar vicinity as a cylinder perpendicular to the Galactic plane, centered on the Sun, with a radius of 0.5 kpc, that extends into the halo to include the stars in the cylinder. In § 4 we compare our chemical evolution models with the protosolar chemical abundances and with those of the H II region M17. Based on the comparison between the observations and the models we present in § 5 a new Galactic chemical evolution model, with intermediate mass loss due to interstellar winds, IWY, that produces considerably better agreement with the observations. In § 6 we compare the IWY model with additional observations, those provided by extragalactic H II regions in spiral galaxies, and those provided by stars in the direction of the Galactic bulge. The conclusions are presented in § 7. A preliminary account of some of the results included in this paper was presented elsewhere (Peimbert et al. 2010).

2. CHEMICAL EVOLUTION MODELS WITH HIGH AND LOW WIND YIELDS

We present chemical evolution models for the Galactic disk. The models have been built to reproduce the present gas mass distribution, (see Figure 1, left panel) and the present-day O/H values for H II regions in the Galaxy for $6 < r(\mathrm{kpc}) < 11$, (see Figure 1, upper right panel) listed by García-Rojas & Esteban (2007). In what follows we describe in detail the characteristics of the models.

(i) In the models the halo and the disk are projected onto a single disk component of negligible width and with azimuthal symmetry; therefore all functions depend only on the galactocentric distance r and on the time t.

(ii) The models focus on $r \geq 4$ kpc; therefore, the physical processes associated with the Galactic bar are not considered.

(iii) The models are based on the standard chemical evolution equations originally written by Tinsley (1980) and widely used to date. See e.g., Pagel (2009), Matteucci (2001), and Prantzos (2008).

(iv) The age of the models is 13 Gyr, the time elapsed since the beginning of the formation of the Galaxy.

(v) The models are built based on an inside-out scenario with infalls that assume primordial abundances $Y_p = 0.2477$, $Z = 0.00$ (Peimbert et al. 2007). The adopted double infall rate is similar to that presented by Chiappini, Matteucci, & Gratton (1997), as a function of r and t, and is given by $\mathrm{IR}(r,t) = A(r)e^{-t/\tau_{\mathrm{halo}}} + B(r)e^{-(t-1\mathrm{Gyr})/\tau_{\mathrm{disk}}}$, where the halo formed in the first Gyr with a timescale $\tau_{\mathrm{halo}} = 0.5$ Gyr, and the disk started forming immediately after with longer timescales that depend on r, $\tau_{\mathrm{disk}} = (8 \times r/r_{\odot} - 2)$ Gyr. We adopt 8 kpc for the Galactocentric distance of the solar vicinity, $r_{\odot}$. The variables $A(r) = 10\ M_{\odot}\ \mathrm{pc}^{-2} \times e^{-[r(\mathrm{kpc})-r_{\odot}]/3.5\ \mathrm{kpc}}$