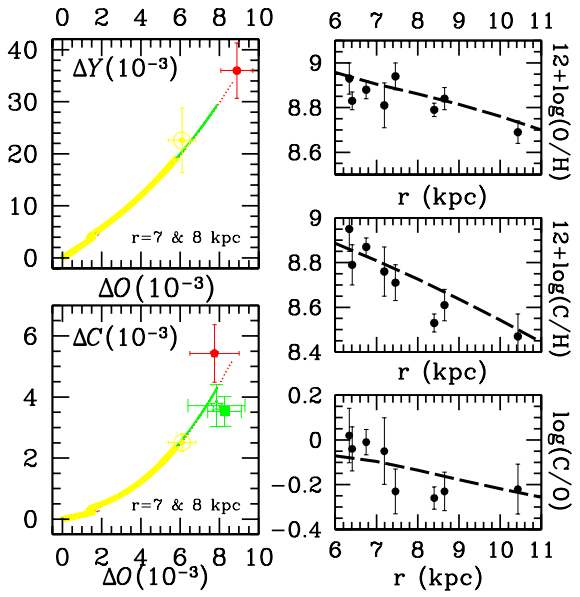

Fig. 1. Chemical evolution model for the solar vicinity and the Galactic disk. The left panels show the 0–13 Gyr evolution of ΔY vs ΔO and of ΔC vs ΔO for $r = 7$ kpc (dotted red lines) and $r = 8$ kpc (thin solid green line), the thick yellow lines show the evolution from 0 to 8.5 Gyr for $r = 8$ kpc. The right panels show the present-day ISM abundance ratios as a function of galactocentric distance. Data. Filled red pentagon: Average values of the M17 and M20 H II regions from Carigi & Peimbert (2008) at $r = 6.75$ and 7.19 kpc, respectively. Yellow ⊙: Protosolar values by Asplund et al. (2009). Empty green star: Average values of young F-G dwarf stars of the solar vicinity from Bensby & Feltzing (2006). Filled green square: Average values of NGC 3576 and Orion H II regions at $r = 7.46$ and 8.40 kpc. Filled black circles: H II regions (García-Rojas & Esteban 2007), gas (García-Rojas & Esteban 2007) plus dust correction (Peimbert & Peimbert 2010).

In Figure 1 we present our model together with the best observational constraints available (those listed above). The model was built to reproduce the O/H gradient (upper right panel) assuming an inside-out scenario and intermediate wind yields (moderate mass loss rate for massive stars of $Z_{\odot}$). Specifically our model is able to reproduce the following observational constraints presented in the other four panels: (a) the current O/H, C/H, and C/O abundance gradients (slopes and absolute values) derived from Galactic H II regions; (b) the O/H, C/H, and Fe/H values and Fe/H-time relation derived from halo and disk stars of different ages in the solar vicinity; (c) the He/H, C/H, O/H, and Fe/H protosolar abundances that correspond to those present in the interstellar medium 4.5 Gyr ago; and (d) the He/H, C/H, and O/H values of the Galactic H II regions M17 and M20.

From the protosolar $12 + \log(\mathrm{O/H}) = 8.73 \pm 0.05$ value by Asplund et al. (2009) and the O/H values predicted by our GCE model for $r = 8$ and $r = 7$ kpc of 8.70 and 8.77 for the ISM when the Sun was formed ($t = 8.5$ Gyr), we obtain that the Sun originated at $r = 7.6 \pm 0.8$ kpc.

We also decided to compare our best models with the C/O vs O/H results derived by Esteban et al. (2002, 2009) from bright H II regions in nearby spiral galaxies based on recombination lines and including the dust correction.

3. CONCLUSIONS

The agreement of the He/O, C/O, and Fe/O ratios between the model and the protosolar abundances implies that the Sun formed from a well mixed ISM, since about half of the freshly He (and C) is produced by massive stars and half by low-and-intermediate-mass stars (Carigi et al. 2005; Carigi & Peimbert 2008), and an important fraction of the Fe comes from SNIa.

The agreement of our model with the protosolar abundances and the Sun-formation time supports the idea that the Sun originated at 7.6±0.8 kpc, close to its current galactocentric distance ($r = 8$ kpc).

We obtain that our chemical evolution model of the Galactic disk for the present time produces a reasonable fit to the O/H-C/O relation derived from H II regions of nearby spiral galaxies. This agreement might imply that spiral galaxies have a similar IMF, no selective outflows, and probably a formation scenario similar to that of our galaxy (for a more general discussion of this issue see Carigi & Peimbert 2011).

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