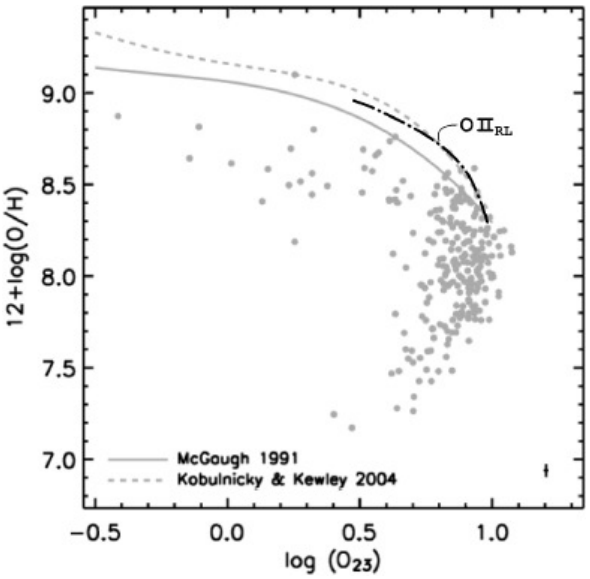

Fig. 1. Calibration from the work of Peimbert et al. (2007) for a parameter P =[O III] 4959+5007 Å ([O II] 3726+3729 Å + [O III] 4959+5007 Å)=0.8. The figure also shows the calibrations made by McGaugh (1991) and Kobulnicky & Kewley (2004), both based on photoionization models.

al. 2004, 2005; Peimbert et al. 2007; Esteban et al. 2009) show that the O^{++}/H^{+} ratio obtained from RLs and from the correction on the CELs' abundance due to the temperature inhomogeneities measured from faint He I lines, is from 0.10 to 0.35 dex higher than the values obtained from CELs under the usual assumption of thermal homogeneity.

To avoid the problem of the exponential temperature dependence of CELs, RLs can be used to measure abundances. However, RLs of heavy elements are extremelly faint, limiting their usefulness to high metallicity objects. For low metallicity objects, one alternative is to determine the ADF from the value of t^2 obtained from the thermal discrepancies between temperatures determined through RLs and temperatures obtained with CELs.

When correcting abundances from CELs for the effect of t^2, we find that for NGC 456 abundances are 1.75 times higher than with the traditional assumption of thermal homogeneity (see Table 1). This means that the point corresponding to NGC 456 in the $O_{23}-O/H$ diagram shifts up by 0.24 dex on the value of 12+log(O/H), which is slightly smaller than values determined from RLs in the upper branch of the diagram.

We have recalculated abundances considering thermal inhomogeneities for other 4 low metallicity objects and we find that their abundances are higher by a factor of about 2 than abundances traditionally determined. This implies that their corresponding points in the $O_{23}-O/H$ diagram will also shift up. The systematic shifting upwards in the 12+log(O/H) axis in both branches of the diagram implies that abundances of heavy elements in the Universe are underestimted by approxmately a factor 2.

TABLE 1

CHEMICAL ABUNDANCES OF NGC 456

	$t^2 = 0.000$	$t^2 = 0.067 \pm 0.013$
Element	12+log(X/H)±error	12+log(X/H)±error
Helium	10.923±0.008	10.918±0.008
Nitrogen	6.67±0.01	6.90±0.03
Oxygen	7.99±0.02	8.23±0.05
Neon	7.25±0.01	7.51±0.05
Sulfur	6.45±0.04	6.42±0.14
Chlorine	4.45±0.02	4.70±0.08
Argon	5.76±0.04	5.97±0.13

The implications of this study are of great importance in many fields of astronomy. Our results imply that: (1) there are 2 times more stars forming in H II regions, (2) determinations of *yields* have to be recalculated, (3) the IMF would also have to be reevaluated, (4) some modifications have to be made to chemical evolution models of the Universe, and (5) there are 2 times more places in the Universe where heavy elements provide the necessary ingredients for life to begin.

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