Wolf-Rayet stars (Luts et al. 2004). Therefore, [O IV] cannot be solely associated with the power of the AGN (see Weaver et al. 2010 for discussion). Figure 9 in Weaver et al. 2010 shows the observed [Ne III]/[Ne II] and [O IV]/[Ne III] ratios for different sources where it can be seen, (1) the BAT AGN branch; (2) below the BAT AGN are the starburst (SB) and HII galaxies which have an apparent [Ne II] excess; (3) above and to the left of the BAT AGN are the Blue Compact Dwarft (BCD), and (4) LINERs, which seem to follow a connecting path between AGN and SB/HII galaxies.

In order to study the physical conditions in the emission-line regions of active galaxies, starburst and composite systems (AGN+SB) we carried out extensive photoionization calculation using CLOUDY (Ferland et al. 1998). Our constant density and plane parallel calculations are designed to model the emitted spectrum of a slab of gas illuminated by radiation emitted by hot, young stars and the AGN, therefore, used two different spectral energy distributions (SEDs), one for each physical process. The star formation SED is designed to maximize the number of photons emitted above the Ne^{3+} ionization limit, while our AGN continuum is a broken power law as used by (Melendez et al. 2008) of the form $F_\nu \propto \nu^{-\alpha}$, with $\alpha = 0.5$ below 13.6 eV, $\alpha = 1.5$ from 13.6 eV to 1 keV and 0.8 at higher energies. We used solar and Orion abundances for the AGN and starburst model, respectively.

From this we generated a grid of models were we varied the hydrogen density, $n_{\rm H}$, between 10^2 and 10^7 cm^{-3}, and an ionization parameter U between $10^{-0.5}$ to $10^{-4.5}$, where the ionization parameter U is defined as:

$$U = \frac{1}{4\pi R^2 c n_{\rm H}} \int_{\nu_0}^{\infty} \frac{L_\nu}{h\nu} d\nu = \frac{Q({\rm H})}{4\pi R^2 c n_{\rm H}}, \qquad (1)$$

where R is the distance to the cloud, c is the speed of light and Q(H) is the flux of ionizing photons.

3. RESULTS AND CONCLUSIONS

We used a single-zone AGN and starburst model to reproduce the physical conditions in a sample of galaxies. Assuming a total hydrogen column density of $N_{\rm H} = 10^{21}$ cm^{-2} we found that a single-zone model can only reproduced the observed [O IV]/[Ne III] and [Ne III]/[Ne II] ratio in a few sources in the AGN and starburst sample. This is probably due to the fact that we are comparing emission lines that have a wide range of ionization potentials and critical densities. Therefore, a more realistic model should included a combination of a radiation- and matter-bounded components. From this we constructed a two-zone model where we found that AGN can be fitted by a combining of two clouds, one at a low ionization ($U \sim 10^{-4}$) and high density ($n_{\rm H} \sim 10^6$ cm^{-3}) and another one at a higher ionization ($U \sim 10^{-1}$) and lower density ($n_{\rm H} \sim 10^3$ cm^{-3}), while starburst galaxies can also be fitted by combination of a cloud at a low ionization ($U \sim 10^{-4}$) and another cloud at a higher ionization ($\sim 10^{-1}$) with a hydrogen density roughly constant. Figure 1 shows the AGNs and starburst galaxies reproduced by our model of two-zone versus the observations.

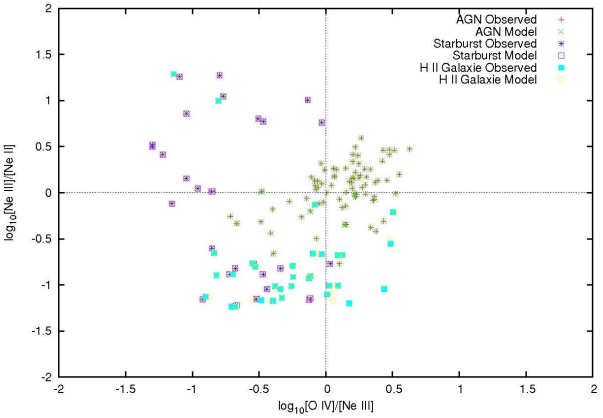

Fig. 1. Comparison between the [Ne III]/[Ne II] versus [O IV]/[Ne III] for a sample of BAT AGN, LINERs, starburst galaxies, HII galaxies and BCDs from (Weaver et al. 2010) and our two-zone models. The dashed lines represent a value of unity for the [Ne III]/[Ne II] and [O IV]/[Ne III] ratios.

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