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A COMPREHENSIVE STUDY OF HIGH-METALLICITY GIANT EXTRAGALACTIC H II REGIONS: IONIZING POPULATIONS

M. Castellanos,[1] A. I. Díaz,[1] and E. Terlevich[2]

Theoretically, the evolution of a young stellar population depends on metallicity at least through two very important effects: the increasing opacity of the stellar material and the dependence of mass loss on metal content in high mass stars. As a consequence of the first, the effective temperature of ionizing stars should be lower in regions of higher metallicity (see for example McGaugh 1991) but, on the other hand, as a consequence of the second, that is if the strength of stellar winds increases with metallicity, the loss of the outer envelopes of the most massive stars can increase their surface temperature to very high values. These highly evolved massive O stars are identified with the Wolf-Rayet population.

It must be stressed the importance of observing WR stars in high metallicity H II regions in order to verify both the assumed mass loss rates and the predicted characteristics of the WR features in these environments. This work must rely on the calculation of accurate oxygen abundances in these regions (see Castellanos, Díaz & Terlevich 2002, these proceedings).

Wolf-Rayet features have been detected in the four observed GEHRs, and are specially prominent in region H13 (NGC 628). In this region, when comparing both the emission line spectrum and the inferred abundances with those derived in the nearby region H3, it is confirmed that they close resemble each other, despite the presence of Wolf-Rayet stars in region H13. From this result, it can be concluded that the presence of WR stars in this region does not alter its ionization structure. This fact can be understood in terms of the low derived value for the WR/O star ratio. Another fact that supports the previous conclusion is the isothermal behavior observed in H13.

From the calculation of single-star photoionization models, one striking result is the derived constancy for the mean effective temperature of the ionizing clusters in the four GEHRs, with a value around 35,000 K (Mihalas models). This result is remarkable given the scatter in the derived metal abundances and Wolf-Rayet properties for the observed GEHRs. It can be inferred again that the number of WR stars vs. O stars is fairly low and not sufficient to change the global properties of these regions.

Regarding Wolf-Rayet population models (Schaerer & Vacca 1998), these can fairly fit both the individual and global properties of the observed Wolf-Rayet features (line intensities and equivalent widths). As for evolutionary synthesis models (Leitherer et al. 1999), both emission line intensities and ionic abundances in region H13 are consistently fit by a single instantaneous burst at an age between 4–4.5 Myr producing the WR population. Tentatively, emission line intensities and total abundances (not the ionic ones) in CDT1 in NGC 1232 could be fitted by a single ionizing cluster at an age between 6–7 Myr, producing the WR population, but the predicted Hβ equivalent width is lower than the observed one by a factor of two. This would indicate the presence of another young ionizing cluster in this region. In the case of regions CDT3 and CDT4 (NGC 1232), single cluster models between 3 and 4.5 Myr, though compatible with predictions for the observed WR features, result too hard in comparison with the observed emission line spectra. In this case, composite populations need to be assumed. This point suggests the presence of different ionizing clusters (different populations) powering these GEHRs.

[1]Depto. de Física Teórica, UAM, 28049 Madrid, Spain (marcelo,angeles@pollux.ft.uam.es).
[2]INAOE, 72000 Puebla, México (eterlevi@inaoep.mx).

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