

Wolf-Rayet galaxies at many radio wavelengths and H α : radio super-star-clusters

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Abstract. We have observed nine Wolf-Rayet galaxies at 20,6, 3.6 and 2 cm from the *VLA* and at H α from the *Wise Observatory*, and have mapped the radio spectral index in each galaxy on sub-arcsec scales. We find that more than half the WR sample has distinct regions where the radio spectrum rises between 6 and 2 cm. We believe that this is the radio signature of the youngest super-star-clusters which are otherwise invisible, and which require $N_{\text{Lyc}} \gtrsim 10^{52}$, or equivalent to 750 stars of the O7 subtype. We call these sources *radio super-star-clusters*.

Background and results

We have mapped a sample of WR galaxies, the youngest starbursts known, in the radio (from the *VLA*) and H α (from *Wise Observatory*). The radio emission from galaxies is usually a combination of non-thermal synchrotron radiation from SNRs and thermal emission from H II regions, but our *VLA* mapping has found another spectral component: individual sources whose spectral index, α , is *positive* between 6 and 2 cm, meaning that they are optically thick at wavelengths as short as 6 cm. We believe that these rising spectrum sources, which are highly optically obscured, are *radio super-star-clusters*. They must have very high emission measures ($> 10^8$) and densities ($> 10^4$), which implies that they are extremely young (Turner, Ho & Beck 1998), in fact the youngest regions of star formation in these galaxies. They appear analogous to the Galactic ultra-compact H II regions, which are no more than a million years old. But UC H II regions contain one star; these sources have the ionization of several hundred O-type stars each. These radio super-star-clusters may be common in intense starbursts, they can provide most of the radio emission, and until 100 μm and 60 μm maps with arcsec resolution are made they can probably be seen only in the radio. The WR galaxies are even more extreme than we have suspected!

References

Turner, J., Ho, P.T.P.H., Beck, S.C. 1998, *AJ* 116, 1212