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KINEMATICS OF METAL-RICH CIRCUMNUCLEAR REGIONS FROM FUTURE 8-M CLASS OBSERVATIONS

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We have measured gas and stellar velocity dispersions in 5 circumnuclear starforming regions (CNSFRs) and the nucleus of the barred spiral galaxy NGC 3351. The stellar dispersions have been measured from high resolution spectra of the Ca II λλ 8494, 8542, 8662 Å triplet lines (CaT), while the gas velocity dispersions have been measured by Gaussian fits to the Hβ λ 4861 Å and [O III] λ 5007 Å lines on high dispersion spectra. We determined the line of sight stellar velocity along each slit. Extractions were selected such as to maximize signal-to-noise while preserving spatial resolution.

The rotation velocities derived for both stars and gas are in reasonable agreement, although in some cases the gas shows a velocity slightly different from the stars. The rotational curve corresponding to the position going through the centre of the galaxy shows maximum and minimum values at the position of the circumnuclear ring. The radial velocity curve shows deviation from circular motions for the ionised hydrogen consistent with its infall towards the central regions of the galaxy at a velocity of about 25 km s^{-1}. Our results are consistent with those found by Rubin et al. (1975). Detailed analysis is available in a forthcoming paper (Hägele et al., in preparation). Stellar velocity dispersions are between 46 and 76 km s^{-1}. Stellar and gas velocity dispersions are found to differ systematically by about 20 km s^{-1} with the Hβ lines being narrower than both the stellar lines and the [O III] λ 5007 Å lines. The best Gaussian fits involved two different components for the gas: a "broad component" with a velocity dispersion similar to that measured for the stars, and a "narrow component" with a dispersion systematically lower than the stellar. When plotted in a [O III]/Hβ *vs* [N II]/Hα diagnostic diagram, the two systems are segregated with the narrow component having the lowest excitation and being among the lowest excitation line ratios detected for example, by the SDSS dataset.

The CNSFRs, with sizes of about 100 to 150 pc in diameter, are seen to be composed of several individual star clusters with sizes between 1.7 and 4.9 pc on the F606W WFPC2-HST image. Using the stellar velocity dispersions, we have derived dynamical masses for the entire star forming complexes and the individual star clusters. Dynamical masses for the whole CNSFRs are between 4.9×10^6 and 4.34×10^7 M$_\odot$ for the CNSFRs and 3.5×10^7 M$_\odot$ for the nuclear region inside the inner 11.3 pc, and between 1.8 and 8.7×10^6 M$_\odot$ for the individual star clusters. These values are between 5.5 and 26 times the mass derived for the super star cluster (SSC) A in NGC 1569 by Ho & Filippenko (1996). Masses derived from the Hβ velocity dispersion under the assumption of a single component for the gas would have been underestimated by factors between approximately 2 to 4.

Masses of the ionising stellar clusters of the CNSFRs have been derived from their Hα luminosities under the assumption that the regions are ionisation bound and without taking into account photon absorption by dust. Their values are between 4.1×10^5 and 2.42×10^6 M$_\odot$ for the starforming regions, and 3.1×10^5 M$_\odot$ for the nucleus, comparable to that derived by González-Delgado et al. (1994) for the circumnuclear region A in NGC 7714. The ratio of the ionising stellar population to the total dynamical mass is between 0.01 and 0.11. Derived masses for the ionised gas vary between 3×10^3 and 8.6×10^4 M$_\odot$ for the CNSFRs, and 1×10^3 M$_\odot$ for the nucleus, also comparable to that derived by González-Delgado et al. (1994).

The existence of more than one velocity component in the ionised gas corresponding to kinematically distinct systems, deserves further study. To disentangle the origin of these two components it will be necessary to map these regions with high spectral and spatial resolution and much better S/N in particular for the O^{2+} lines making this problem an ideal project to solve with the GTC.

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