THE GALACTIC CENTER STAR CLUSTER: NORMAL EVOLUTION !?

DANIEL SCHAERER
Geneva Observatory, CH–1290 Sauverny, Switzerland

1. Introduction

The star cluster in the Galactic center (GC) provides an exceptional test-ground for the evolution of stars in extreme environments. Its understanding is an important step for the study of stellar populations in starburst galaxies and AGN's. In this work we address the question if the central cluster can be understood by standard evolutionary scenarios, or whether other processes (collisions, mergers, atmosphere stripping etc.) need to be invoked. A more detailed account of this work will be published elsewhere.

2. Normal evolution

Evidence for the massive star population comes from the ionising radiation field and the first direct K-band observations. Let us now combine both informations to obtain a quantitative estimate of the different stellar types. *(i)* The number of Lyman continuum photons is $\log Q_0$=49.6 to 50.4, and $\log Q_1$=48.4 to 49.2 (Krabbe et al. 1991, Genzel et al. 1993). To reproduce the ionising radiation field thus only requires 2 to 22 equivalent O7 V stars (cf. Vacca & Conti 1992). Note that the contribution of the emission line stars to Q_0 and Q_1 is negligible (Najarro et al. 1994). *(ii)* The recent spectral analysis of the HeI/HI emission line star (spectral type Of/WN, henceforth called AF; Najarro et al.) yields stellar parameters, including surface abundances, which show a very good agreement with the evolutionary grids of Meynet et al. (1994) at Z=0.04 (cf. Shields & Ferland 1994), indicating that the AF star can be attributed to the socalled WNL phase of our tracks, with an initial (present) mass of $\sim$ 25 (10) $M_\odot$. Note that the mass loss rates used in these models are supported by the extensive

L. Blitz and P. Teuben (eds.), Unsolved Problems of the Milky Way, 279–280.

https://doi.org/10.1017/S0074180900229781 Published online by Cambridge University Press

comparisons of Maeder & Meynet (1994) showing a good agreement with observations in regions with constant star formation.

Assuming the AF star to be representative for the other $\sim$ 14 emission line stars, we thus derive a number ratio of these stars (called WNL*) to O7 V stars of $WNL^*/(WNL^* + O7V) = 0.4$ to 0.9, which is of the same order as observed in WR galaxies (Vacca & Conti 1992). This value can directly be compared to the predictions of Meynet (1994) for instantaneous star formation, which are based on the same tracks as used above. From his Fig. 3 (high mass loss) one obtains that the massive star population of the central star cluster can be explained by standard evolutionary models and adopting a normal IMF. The age of the cluster is then found to be 7–8 Myr, younger ages being excluded by the absence of WC stars and the stellar parameters of the AF star.

3. Discussion

Using simple observational constraints we have shown that with the present knowledge about the massive star population the GC star cluster can be explained by standard evolutionary models and a normal IMF yielding an age of 7 to 8 Myr. No particular processes like mergers etc. seem to be required. In fact this simple picture is also compatible with the integrated K, and the total IR luminosity. Several late type stars are also present in the cluster, their nature being partly disputed (cf. Genzel et al. review). The presence and the number of M-K supergiants can also be explained within the above scenario. It is clear, however, that if some cluster members are in fact AGB stars, the picture must be revised.

Clearly more detailed studies on both the late and the early type stars in the cluster are required to obtain more quantitative determinations of its stellar content. Concerning the emission line stars, calculations of Schaerer (1994) in particular show the large importance of line blanketing on the spectral analysis of AF like stars. This may also be of importance to understand the seeming differences of the GC emission line stars with normal Of/WN stars.

References

Genzel R., Hollenbach D., Townes C.H., 1993, MPE preprint 276
Krabbe A., Genzel R., Drapatz S., Rotaciuc V, 1991, *ApJ* 382, L19
Maeder A., Meynet G., 1994, *A&A* 287, 803
Meynet G., 1994, *A&A*, in press
Meynet G., Maeder A., Schaller G., Schaerer D., Charbonnel C., 1994, *A&AS* 103, 97
Najarro F. et al., *A&A* 285, 573
Schaerer D., 1994, *PhD thesis*, Geneva University
Shields J.C., Ferland G., 1994, *ApJ* 430, 236 Vacca W.D., 1994, *ApJ* 421, 140
Vacca W.D., Conti P.S., 1992, *ApJ* 401, 543

https://doi.org/10.1017/S0074180900229781 Published online by Cambridge University Press