

New Emission Line Planetary Nebulae Nuclei in the Direction of the Galactic Center

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Abstract. We have discovered new Wolf-Rayet type and weak emission-lines nuclei of the planetary nebulae in the Galactic center.

1. Background

About 50 of the planetary nebula nuclei (PNNi) show wide and strong emission lines characteristic for Wolf-Rayet stars. However, contrary to the massive Population I WR stars all the WR PNNi are of WC type. The nature of these objects is not entirely clear. Our analysis of the available observational data shows (Górný & Tylenda 2001) that the direct evolution from the AGB is the most plausible evolutionary scenario, at least for the great majority of them.

Another difference between WR PNNi and the massive WR stars is that the former tend to have either very late or very early WC subtypes. The subtypes WC 5 - WC 8 are clearly avoided for an unknown reason. Either these are two different populations of WR PNNi or the evolution across the middle-types is very fast.

It becomes even more puzzling if one realizes that almost all the middle-type WR PNNi belong to the Galactic bulge (Górný 2001). In the bulge population four objects are of WC 5 - WC 7 type, one is WC 4 and three have uncertain classification. The statistics is low, nevertheless it seems that the bulge and the disc populations of WR PNNi could be fundamentally different.

2. Observations and Results

In order to increase the statistics of the bulge population of WR PNNi we have obtained a long exposure time, low resolution spectra of 32 planetary nebulae for which there existed no spectroscopic information on their central stars. The data was secured with the 1.9-meter telescope at the South African Astronomical Observatory in the wavelength range 3500 - 7500Å. Most of the observed nebulae fulfill the standard criteria for Galactic bulge objects.

We have found one third of the observed objects to show clear signs of stellar emission lines. Two new WR-type central stars could easily be identified and classified: MaC 1-10 is a [WC 8] star and H 1-26 is a [WC4-5] type star. In the other cases the lines necessary for classification are represented only by (substantially narrower) CIV lines at 5001-50012Å. Therefore, most of them are probably not genuine WR PNNi and belong to the group of so-called weak emission-lines central stars of planetary nebulae (see Tylenda et al. 1993). A

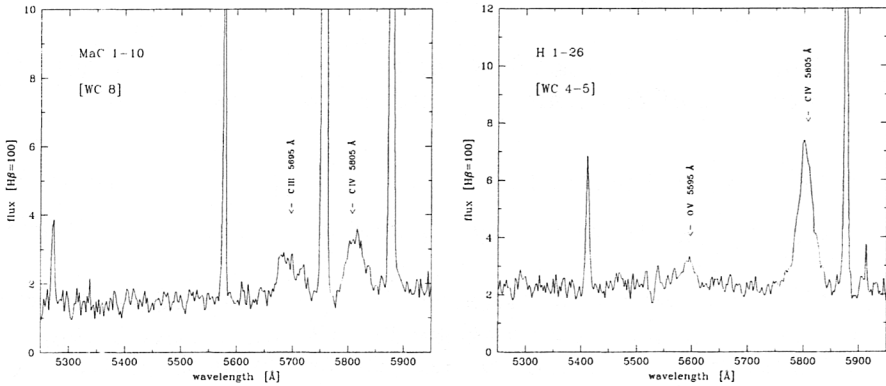


Figure 1. Spectra of the new Wolf-Rayet type central stars.

separate case is M 3-44 showing a narrow C III line at 5695 Å. This suggests the star could be of [WC 11] subtype in agreement with the low excitation state of the surrounding nebula.

Table 1. Observed objects.

PNG	name	stellar emissions
000.7+04.7	H 2-11	no
003.6+03.1	M 2-14	yes
003.9-02.3	M 1-35	no
005.2+04.2	M 3-13	?
005.9-02.6	MaC 1-10	yes, [WC 8]
006.5-03.1	H 1-61	yes
007.2+01.8	Hb 6	no
008.3-01.1	M 1-40	yes
008.3-07.3	NGC 6644	yes
009.6+14.8	NGC 6309	yes
011.0+05.8	NGC 6439	no
014.2+04.2	Sa 3-111	?
015.9+03.3	M 1-39	no
019.7+03.2	M 3-25	no
343.9+00.8	H 1- 5	no
345.2-01.2	H 1- 7	no

PNG	name	stellar emissions
347.4+05.8	H 1- 2	yes
347.7+02.0	Vd 1-8	?
350.1-03.9	H 1-26	yes, [WC 4-5]
352.1+05.1	M 2- 8	yes
352.6+03.0	H 1- 8	no
354.5+03.3	Th 3- 4	no
355.1-06.9	M 3-21	no
356.1+02.7	Th 3-13	yes
356.6-07.8	H 1-57	no
356.9+04.4	M 3-38	?
356.9-05.8	M 2-24	?
358.3+03.0	H 1-17	no
359.1-01.7	M 1-29	no
359.3-01.8	M 3-44	yes, [WC 11]?
359.4-03.4	H 2-33	?
359.9+05.1	M 3- 9	no

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References

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