Planetary Nebulae: An Eye to the Future
Proceedings IAU Symposium No. 283, 2011
A. Manchado, L. Stanghellini & D. Schönberner, eds.

doi:10.1017/S1743921312011520

ATCA radio observations of compact planetary nabulae

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Abstract. We present new observations in the radio continuum of 31 planetary nebulae at 5 and 8 GHz with the Australian Telescope Compact Array. The observations are used to invesigate properties of the interstellar extinction toward Galactic Bulge.

Keywords. planetary nebulae: general, dust, extinction, Galaxy: bulge

1. Introduction

Radio continuum emission brings information on much needed parameters of Planetary Nebulae (PNe): their extents, emission measure or density gradient. The radio emission is not affected by the interstellar extinction. In combination with the optical flux it may reveal the properties of the interstellar extinction.

Stasińska *et al.* (1992) and Tylenda *et al.* (1992) have compared the Balmer decrement flux ratios and 5 GHz flux to the Hβ flux ratios for the Galactic Bulge PNe. They suggested that the ratio of the total to selective absorption R_V value differs from 3.1, typical for the Galactic disk. More recently, Ruffle *et al.* (2004) has estimated an average value of R_V to be equal to 2.0 for the Galactic Bulge PNe. Here, we re-examine their results with a new radio data set from the ATCA (Australian Telescope Compact Array) interferometer.

2. Determination of the R_V

The radio data were collected with the ATCA on November 16, 17 and 18, 2003 at 5 and 8 GHz. 5 min integrations of PNe were altered with observations of phase calibrators in the 'snap-shot' mode. Each nebula was observed approximately one hour in total. 31 PNe were observed, 30 of them being likely members of the Galactic bulge.

16 out of the 30 objects had already been observed with the VLA at 5 GHz. The fluxes measured with the ATCA exceed the VLA fluxes by 10–15% (median is 15%) at 5 GHz (Figure 1). The discrepancy is higher for PNe fainter than 10 mJy. An extreme case is PN G004.8+02.0, with the ATCA flux 3.5 times higher than the VLA flux. The uncertainty of the flux scale may account for only 7% difference.

The observed ratio $S_{5\mathrm{GHz}}/S_{8\mathrm{GHz}}$ varies between ∼1-1.25. The 5 GHz flux of an optically thin PN should exceed the 8 GHz flux by 7 percent. Both higher than expected $S_{5\mathrm{GHz}}/S_{8\mathrm{GHz}}$ flux ratio and the discrepancy between the VLA and ATCA fluxes may be explained by slightly underestimated 5 GHz flux of the ATCA calibrator.

R_V values calculated for the nebulae meeting the selection criteria ($100 > S_{5\mathrm{GHz}} > 10$, $T_\mathrm{b} < 1000K$) are presented in the Figure 2. The obtained values of R_V range from 0.84 to 2.85 for the Bulge nebulae. The mean R_V for 20 planetary nebulae equals to 2.0. Our

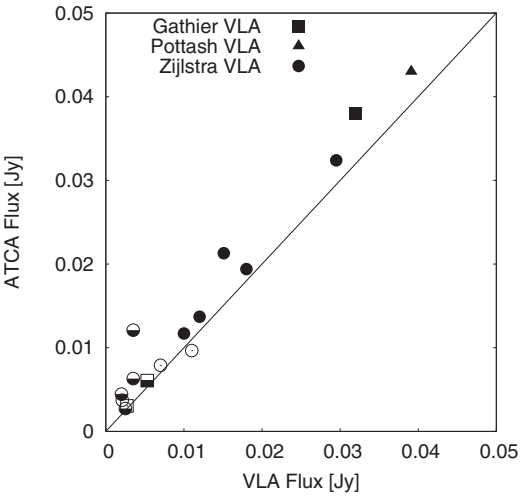

Figure 1. Comparison of the ATCA and the VLA fluxes.

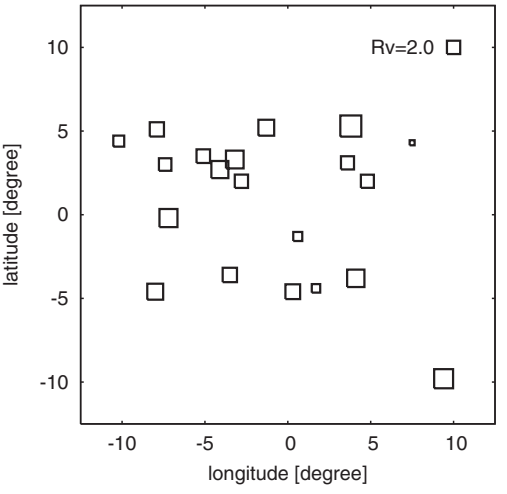

Figure 2. R_V parameter for PNe determined from the ATCA observations combined with the values given by Ruffle *et al.* (2004).

results confirm these obtained by Ruffle (2004). The sample of the objects has increased from 13 up to 20.

Acknowledgements

This work was financially supported by MNiSW of Poland through grant No. N N203 511838.

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