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Structure of ionized gas around AGN

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Abstract. We have observed the [OIII] λ5007 line emission of seven PG quasars with the Hubble Space Telescope using linear-ramp filters. Two quasars show compact filamentary structures which may be related to radio outflows. Including a sample of Seyfert galaxies we tentatively find that the size of the narrow-line region is proportional to the square root of the [OIII] and Hβ luminosity. It can be interpreted in terms of a constant photoionization parameter.

1. Summary

We have observed the narrow-line regions (NLRs) of a sample of the seven brightest radio-quiet PG quasars ($z < 0.5$) with the Wide Field Planetary Camera 2 on board the Hubble Space Telescope (HST). Linear-ramp filters were used to image the [OIII] λ5007 line emission with $0\farcs0455$-$0\farcs1$ pixel resolution. We find that the NLRs are remarkably compact with typical extents of $2''$-$4''$. Generally, the structure is relatively symmetric, in agreement with the unified scheme, that predicts a view into the ionization cones of these type 1 objects. Two quasars exhibit compact filamentary structure like that seen for Seyferts (see Fig. 1). These structures may be related to radio outflows (e.g. Miller, Rawlings, & Saunders 1993). When including a sample of Seyfert galaxies observed with HST in a very similar fashion, the NLR in quasars seems to be consistent with being a scaled-up version of the NLR in Seyferts. In addition, the size of the NLR seems to scale roughly with the square root of the [OIII] luminosity (see Fig. 2 left). We note that a similar relation is found, when plotting the NLR size versus the Hβ luminosity. We derived $L_{\mathrm{H}\beta}$ by multiplying our $L_{\mathrm{[OIII]}}$ with the Hβ/[OIII] ratios taken from spectroscopy. Since the average [OIII]/Hβ ratio of the Seyfert 2s is 30 times larger than that of the quasars in agreement with the unified model we have multiplied the inferred narrow line Hβ luminosities of the Seyferts by a factor of 30 to estimate their total Hβ luminosities. The resulting R versus $L_{H\beta}$ relationship is consistent with an extrapolation to lower luminosity of the relationship found for the quasars (see Fig. 2 right). The slope in Fig. 2 is comparable to the scaling found for the size of the broad-line region with continuum luminosity (e.g. Kaspi et al. 2000). It can be interpreted in

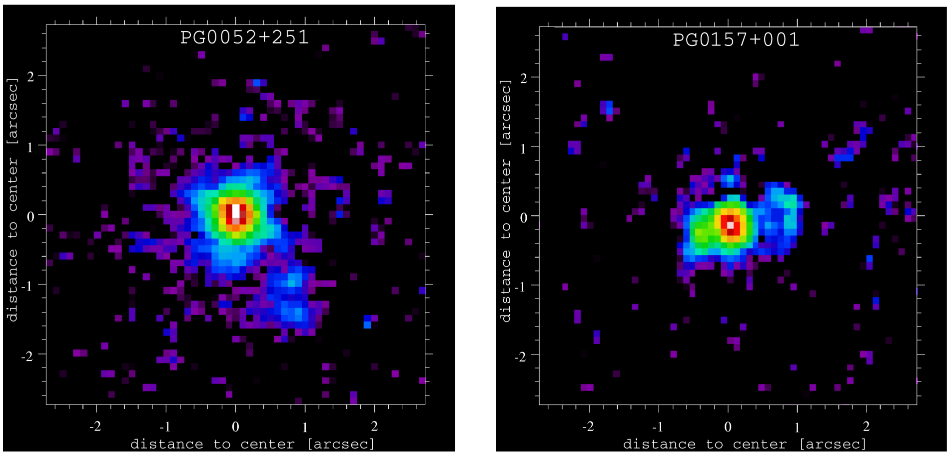

Figure 1. LRF images of PG0052+251 (left) and PG0157+001 (right) in [OIII] λ5007 in a logarithmic scale in false colours. North is up, east is to the left.

terms of a constant photoionization parameter. A detailed description of the presented results can be found in ApJ Letters (Bennert et al. 2002).

References

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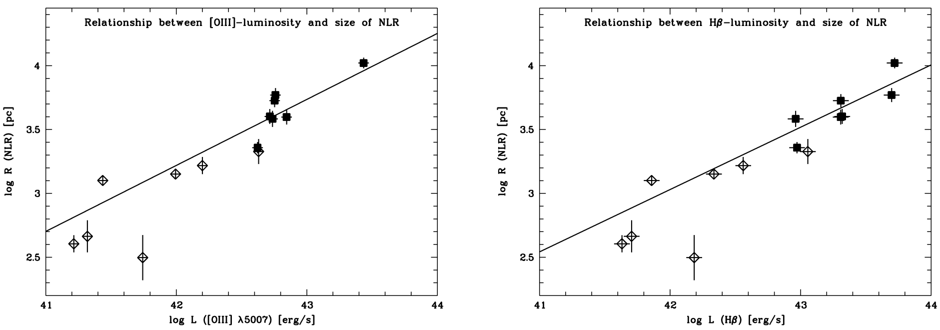

Figure 2. These panels show the radius of the NLR versus the emission-line luminosity in [OIII] λ5007 (left) and in Hβ (right) on logarithmic scales. The open diamonds are Seyferts, the filled squares are PG quasars. The solid lines show weighted linear fits resulting in R $\propto$ ${L_{[\mathrm{OIII}]}}^{0.52}$ (left hand panel) and R $\propto$ ${L_{\mathrm{H}\beta}}^{0.49}$ (right).