PKS 1610–771: a Highly Reddened Quasar?

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1. Introduction

About ten to twenty more or less convincing cases of gravitationally lensed quasars are presently known (Keeton & Kochanek, 1996). Most of these lensed quasars have been discovered on the basis of their apparently large absolute luminosities and high redshifts.

Following these criteria, the radio-loud highly polarised quasar PKS 1610–771, at $z = 1.710$ (Hunstead & Murdoch, 1980) was a good potential candidate. The quasar was first observed under poor-seeing conditions in August 1991 by Meylan and Djorgovski, using the ESO 3.5-m New Technology Telescope (NTT). In spite of these non-optimal seeing conditions, the object appeared double.

In April and May 1995, we were able to obtain, under much better seeing conditions, new NTT-EMMI *R* and *I* images of the field of PKS 1610771 as well as long-slit low-resolution spectra of both the quasar and its companion.

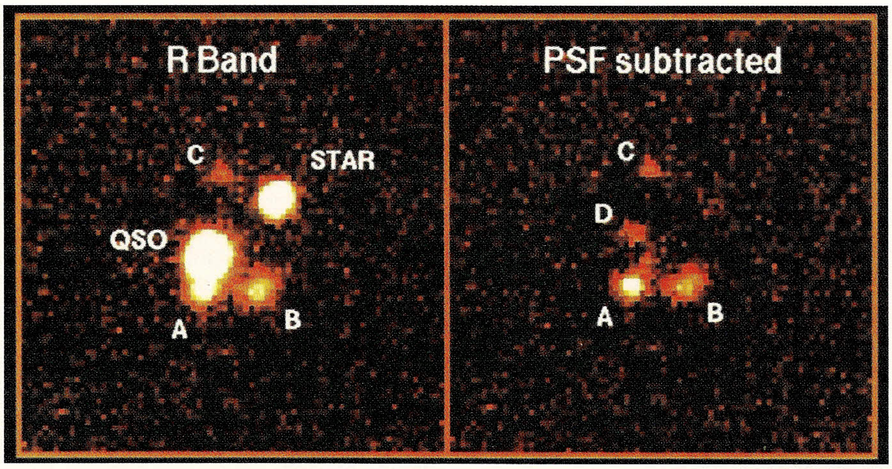

Figure 1: Left: NTT-EMMI R band image of PKS 1610–771 (1200-second exposure, 0.85≤ seeing). The field is 20≤ wide, North is up and East to the left. Right: same image, but a Point Spread Function (PSF) has been subtracted from the quasar and its companion. Three objects (A, B, D) can be seen very close (angle wise) to the QSO. The A–D fuzzy elongation appears perpendicular to the polarisation E vector of the quasar, suggesting their physical relation.

2. Not a Gravitational Lens . . .

Thanks to the relatively good seeing conditions during the nights of April 17–18, 1995 (FWHM = 0.8″) and May 16–17, 1995 (FWHM = 0.9″) the imaging of PKS 1610–771 not only confirmed a double point source structure, but also revealed at least three extended objects very close (closer than 2″) to the line of sight (A, B and D on Fig. 1).

The slit of the EMMI red arm spectrograph was subsequently oriented along a direction joining PKS 1610–771 and its brightest point-like companion. In case of gravitational “splitting” of light by a massive object on the line of sight to the quasar, the two spectra should be essentially identical. This is not the case here. After a total of two hours of integration in low-dispersion mode (EMMI grism #1), the second point source, located 4.55″ north-west of the quasar, turns out to be a late-type star.

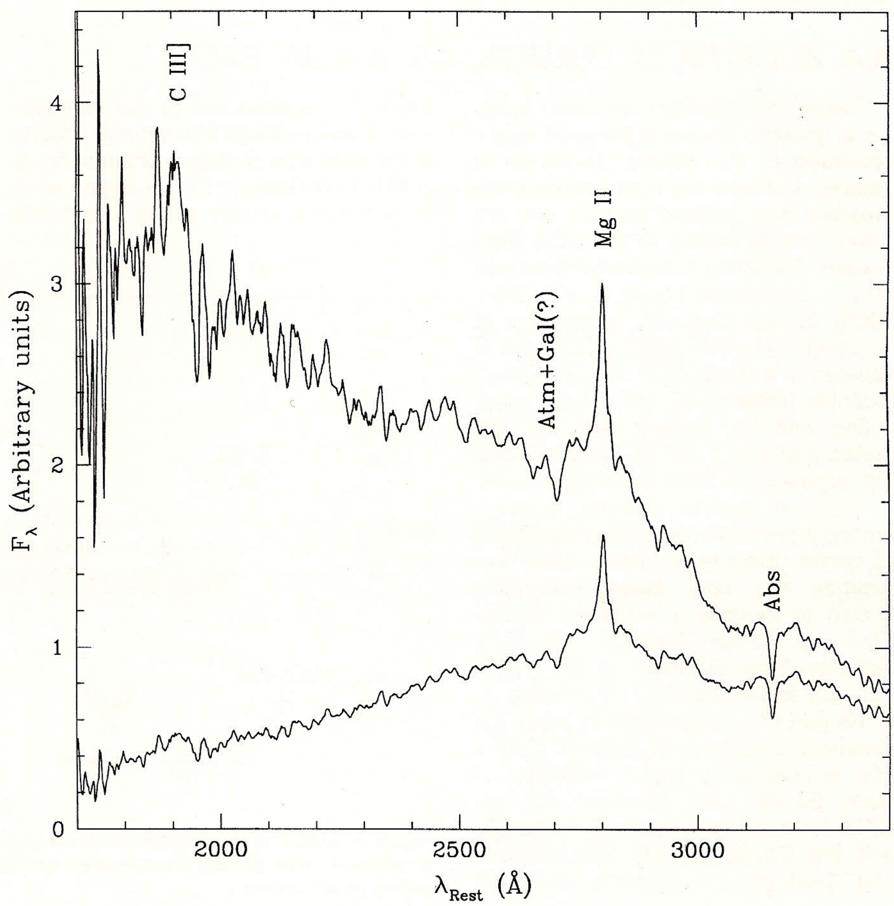

Figure 2: The spectrum of PKS 1610–771 (bottom) in the rest wavelength frame. Its unusual convex shape could be due to internal reddening, as illustrated by the de-reddened version of the spectrum (top).

3. . . . But a Surprising Object

Despite the fact that PKS 1610–771 is not a new gravitationally lensed quasar, its spectrum yields a surprise. The spectrum shows a curved continuum breaking at 7600 Å (2800 Å rest frame) (Fig. 2). In order to be sure that this unusual shape was not due to atmospheric refraction, we re-observed the quasar in May 1995 with the slit carefully oriented along the parallactic angle. The spectra of several spectrophotometric standard stars were obtained under similar conditions and used to check the accuracy of the flux calibration (see for more details Courbin et al., 1996). The results obtained confirmed our previous observations indicating that the weird spectrum shape is not due to atmospheric refraction.

Only very few quasars are known to have spectra similar to PKS 1610–771. These unusual spectra lead up to several interpretations out of which it is always difficult to draw a definite conclusion (e.g. Turnshek et al., 1994). One of the plausible scenarios which might play a role in the formation of such continuum is related to internal extinction by dust, which could affect many quasar spectra (Webster et al., 1995).

4. Internal Dust Extinction?

The reddening hypothesis was tested by performing a reddening correction of the flux-calibrated spectrum, using an SMC-like extinction law (Prévot et al., 1984) and assuming the dust at the redshift of the quasar. Figure 2 displays the result of this de-reddening, i.e., a more usual quasar spectrum. However, this certainly does not prove that reddening is responsible for the convex shape of PKS 1610–771's spectrum, but only that it is compatible with it.

In addition, we noticed that the fuzzy elongations north and south (A and D in Fig. 1) of the QSO are oriented perpendicular to the quasar polarisation angle (Impey & Tapia, 1988, 1990), as usually observed in high-redshift radio galaxies and suggesting that both objects are physically related to the quasar. This could suggest that PKS 1610–771 is a radio-loud quasar highly reddened by its host galaxy, but not completely hidden, its polarisation being due to diffusion by dust rather than synchrotron emission. In the framework of the AGN unification scheme (e.g. Urry & Padovani, 1995, Antonucci, 1993), PKS 1610–771 could be intermediate between quasars and radio galaxies.

The complete version of this study is published in Courbin et al. (1996). Surely, this scenario has to be checked in more detail on the basis of future observations, but we believe that PKS 1610–771 is a very interesting quasar to study in the context of AGN unification scheme.

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Two Planetary Nebulae Discovered in the Sagittarius Dwarf Galaxy

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There are currently nine dwarf spheroidal galaxies known in the near neighbourhood of the Galaxy. These small galactic systems are many times more massive than globular clusters and are gravitationally bound to the Milky Way Galaxy. The latest to be discovered was that in Sagittarius (Ibata et al., 1994, 1995), its late discovery attributable to its proximity to the Galactic Centre. It is situated at a distance of 25 kpc (Galactocentric distance 16 kpc) and is interacting with the Galaxy; with an estimated mass of $\geq 10^7$ $M_\odot$ it is perhaps the largest such local dwarf spheroidal. It contains several globular clusters, among them M 54, which may constitute its centre (Ibata et al., 1995). Until very recently the only dwarf spheroidal known to contain a planetary nebula (PN) was Fornax (distance ~160 kpc), discovered by Danziger et al. (1978) from on- and off-band [O III] imaging.

As part of a programme to study the kinematic properties of Galactic Centre PN, emission-line radial velocities of some 50 PN were obtained with the ESO 1.4-m Coudé Auxiliary telescope and the Coudé Echelle Spectrograph and short camera (spectral resolution 6 km s^{-1}). Subsequent to the observations it was realised that several objects in the extensive objective prism surveys of PN in the Galactic Centre region were in fact in the vicinity of the Sagittarius dwarf galaxy. Comparison of the radial velocity of these PN with that of the Sagittarius dwarf (+140 km s^{-1} with velocity dispersion 10 km s^{-1}) showed that two objects, He 2-436 (004.8–22.7) and

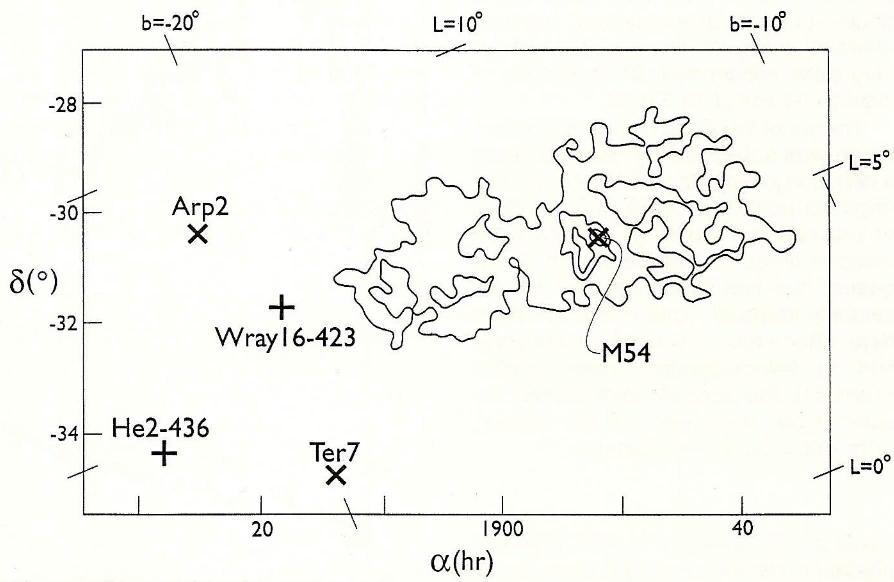

Figure 1: Sketch of the Sagittarius dwarf galaxy and the position of the two PN (pluses). The positions of three globular clusters are also shown (crosses). B1950 equatorial and Galactic coordinates are shown.