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Gas Outflow in the Seyfert Galaxy IC 5063

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IC 5063 (PKS 2048–572) is a nearby ($z = 0.0110$) early-type galaxy hosting a Seyfert 2 nucleus. In broad-band optical images, it shows a complex dust lane, while the ionized gas extends up to ~20 kpc and has an unusual X-shaped structure (Danziger et al. 1981, Colina et al. 1990). A faint, very broad emission-line component has been detected (Bergeron et al. 1983, Colina et al. 1991) together with an off-nuclear broad emission-line region (Wagner & Appenzeller 1989). Broad Hα emission was also detected in polarized light (Inglis et al. 1993). Thus, it is likely that this galaxy has a broad-line region which is obscured from our direct view (while the broad-line radiation is scattered into our line of sight by scatterers outside the obscuring regions). The radio luminosity of IC 5063 is nearly two orders of magnitude larger than typical values for nearby Seyferts (Ulvestad & Wilson 1984), making it one of the strongest radio sources found in Seyfert galaxies (1.3 Jy at 1.4 GHz, i.e., $2 \times 10^{23}\,\mathrm{W\,Hz^{-1}}$ for $H_0 = 50\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$). Its H I content is also very high: Danziger et al. (1981) found $1.0 \times 10^{10}\,M_{\odot}$, which gives $M_{\rm HI}/L_B = 0.4$, quite anomalous for this type of object.

IC 5063 has been observed with the Australia Telescope Compact Array (ATCA) both in the continuum at 8 GHz and in the H I 21-cm line.

Radio continuum: The ATCA map at 8 GHz (resolution $\sim 1''$) is shown in Fig. 1 superposed onto the bright central part of the [O III] λ5007 emission-line map. The radio continuum shows a linear structure consisting of three blobs aligned at $PA = 305°$ and extended over $\sim 4''$ (~ 1.3 kpc). The total flux at 8 GHz is 229.1 mJy. The radio emission is closely aligned with the symmetry axis of the ionized gas. This is in good agreement with the tight alignment between 'ionization cones' and radio axes found in other Seyfert galaxies (e.g., Wilson & Tsvetanov 1994). IC 5063 is, however, somewhat unusual because the ionized gas is distributed in an unique 'X-shaped' structure rather than in a cone.

The position angle the radio emission appears to be approximately perpendicular to that of the optical polarization ($PA = 34°$; Inglis et al. 1993), as expected if the optical emission is scattered into the line of sight by electrons and/or dust grains. This is in agreement with the prediction of the unified schemes of AGN.

Neutral gas: The total intensity map (not shown here) shows H I emission organized in a disk-like structure elongated in the direction of the dust-lane and of the X-shaped ionized gas. The H I disk extends beyond the (optical)

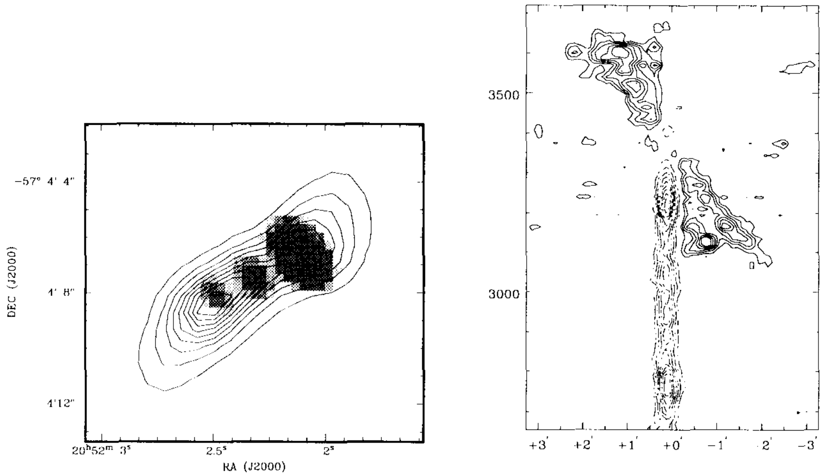

Figure 1. *Left:* 8 GHz radio continuum map (greyscale) and central part of [O III] λ5007 image (contours). *Right:* H I position-velocity map along $PA = 120°$. The vertical axis is in km s^{-1}.

body of the galaxy and shows regular rotation. Strong absorption against the radio continuum is visible in the center of the position–velocity diagram (Fig. 1). At 21 cm, the radio continuum nucleus is spatially unresolved, therefore we cannot determine against which of the three blobs observed at higher resolution the absorption is occuring. The absorption is very broad ($\sim$ 600 km s^{-1}) and blueshifted with respect to the systemic velocity. Thus, the blueshifted absorption in IC 5063 is likely to be the effect of gas outflow resulting from the interactions of the radio plasma with the ISM gas. We are probably looking at a situation similar to what is found in NGC 1068, where a number of absorption regions were found by Gallimore et al. (1994). The overall absorption profile that we observe in IC 5063 is likely to be the result of the absorption due to different regions that at the moment we are not able to resolve.

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