# THE STRUCTURE AND KINEMATICS OF THE IONIZED GAS IN CENTAURUS A

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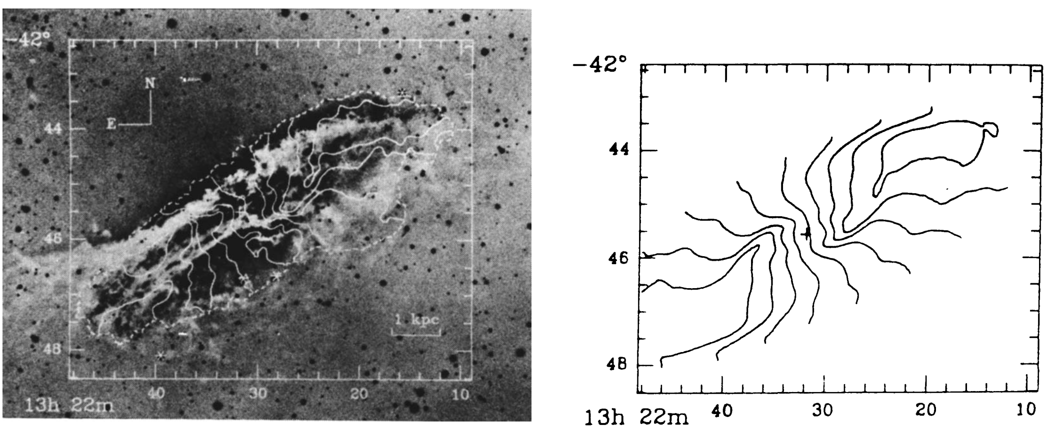
ABSTRACT. The TAURUS Imaging Fabry-Perot System (Taylor & Atherton 1980) has been used with the IPCS at the AAT to observe the ionized gas within NGC 5128 (Cen A) at [NII]λ6548 and Hα. Seven independent (x,y,λ) data cubes were obtained along the dust lane at high spectral resolution (30 km/s FWHM) and at a spatial resolution limited by the seeing (~1"). From these data, maps of the kinematics and intensities of the ionized gas were derived over a 420" by 300" region. The maps are the most complete to date for this object comprising 17500 and 5300 fitted spectra in Hα and [NII]λ6548 respectively. The dust lane system is found to be well understood in terms of a differentially rotating disc of gas and dust which is warped both along and perpendicular to the line-of-sight.




(a) (b)

Figure 1

(a) The TAURUS Hα velocity field is overlayed on an unsharp masked image of Cen A (courtesy of D.F.Malin); the contours are drawn in steps of 50 km/s beginning at 300 km/s in the SE. (b) The model velocity field where contours are drawn in the same way.



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The TAURUS observations are discussed in detail elsewhere (Bland et al. 1986). In Figure 1(a), the derived isovelocity contours have been superimposed on an image of the dust lane system. The well-ordered velocity field is particularly striking in that the kinematic line-of-nodes is complex and not confined to a single position angle. A variety of kinematic models has been explored in order to interpret these new results (Bland and Taylor 1986). It is found that, to first order, the ionized gas is optically thin at H$\alpha$ so that the observed velocity field is the result of seeing throughout the entire gas system. In contrast, the observed dust distribution is due primarily to dust in front of the plane of the sky (assumed to pass through the nucleus of the galaxy), highlighted against the bulk of starlight from the elliptical body. The ionized gas and dust appear to be physically mixed out to a radius of 250"; beyond here, only dust is seen. The proposed warped disc model explains successfully

i) the velocity field of the gas (see Figure 1(b)),
ii) the distribution of HII regions within the dust lane,
iii) the striking appearance of the dust lane system: the familiar dust bands are tangential points of the warp, and
iv) the distribution of broadened, skewed and split line profiles observed within the TAURUS data.

The distribution of line splitting indicates that the disc is thin ( $<<$ 1 kpc) normal to the surface of the warp. The rotation curve implies that the ionized gas moves primarily under the influence of a deep potential well; there is evidence for neither radial nor non-planar components of motion greater than 30 km/s within the system. There are further clues that the gas configuration is at least partially relaxed:

a) the velocity field is well-ordered and bisymmetric,
b) the entire system rotates about a common centre which is coincident with the nucleus of the old stellar population, and
c) its systemic velocity of 536 km/s is identical to that of the stellar component.

On the other hand, it has not been possible to understand the warped disc in the light of recent work on the stability of orbits in both stationary and tumbling, spheroidal and triaxial potentials (van Albada et al. 1982; Steiman-Cameron and Durisen 1984). Thereby, attempts to infer the 3D form of the old stellar component within Cen A have been inconclusive.

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