Extended Line Emitting Regions in the Seyfert Galaxy NGC 2992

L. Colina, K.J. Fricke, W. Kollatschny
Universitäts-Sternwarte Göttingen, West Germany

M.A.C. Perryman
ESA-ESTEC. Space Science Department, Astrophysics Division,
Noordwijk, Netherlands

1. INTRODUCTION

NGC 2992 is a nearby Seyfert galaxy (z=0.008, 1"=150 pc, for H_o=75 km s^{-1} Mpc^{-1}) seen almost edge-on (i=70°). A dust lane crossing the galaxy has been detected (Burbidge et al. 1972, see also Fig. 1) and the presence of two extended radio-emitting regions at position angles P.A. 130° and P.A. 160° has been reported (Ulvestad and Wilson, 1984).

Here we present high-resolution long-slit spectra of the [OIII] emission lines at three different P.A. From these spectra, covering an extension of 25 arcsec on the sky, the velocity field will be discussed as a function of radius and orientation.

2. OBSERVATIONS

NGC 2992 has been observed using the ESA PCD (see di Serego et al. 1985 for details) attached to the ESO 2.2m telescope at La Silla. Long-slit spectra around Hβ+[OIII]λλ4959, 5007Å were obtained at position angles P.A. 26°, P.A. 130° and P.A. 160°. The dispersion was 21Å/mm and the spatial resolution better than 3 increments (1 increment=1 arcsec).

To investigate the internal consistency of our reduction procedure the obtained mean and peak velocities of the integrated spectra at each P.A. were compared. The values obtained, V_{mean}= 2304±10 km s^{-1} and V_{peak}=2381±16 km s^{-1} indicate an internal consistency better than 15 km s^{-1}. In addition our peak value agrees with previous measurements like those of Heckman et al. (1981), 2375±30 km s^{-1}, Vrtilek (1985), 2370±20 km s^{-1} and Whittle (1985), 2409±16 km s^{-1}.

3. VELOCITY FIELD

The peak and mean heliocentric velocity curves of the [OIII] lines at each observed P.A. are plotted in Fig. 2a,b,c together with a synthetic rotation curve obtained from the systemic velocity (V_{sys} = 2328 km s^{-1}, Vrtilek, 1985) plus a projected mean rotation curve for Sa galaxies (Rubin et al. 1985) with absolute magnitude M_B = 21.5 and Holmberg radius R_H = 122".4.

E. Ye. Khachikian et al. (eds.), Observational Evidence of Activity in Galaxies, 131–133.

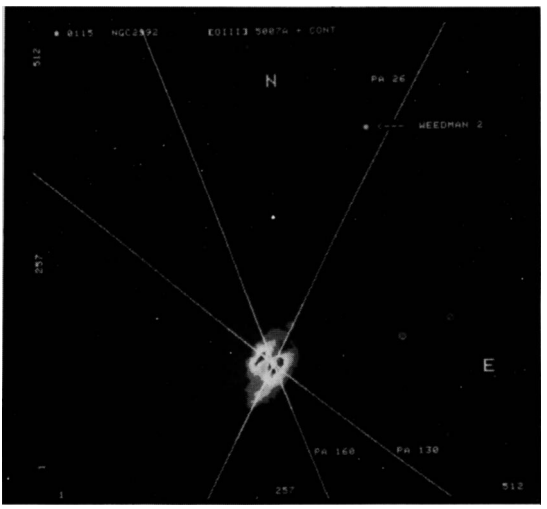
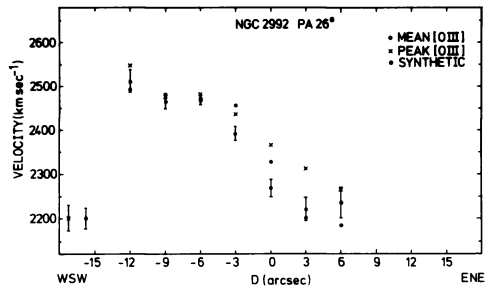
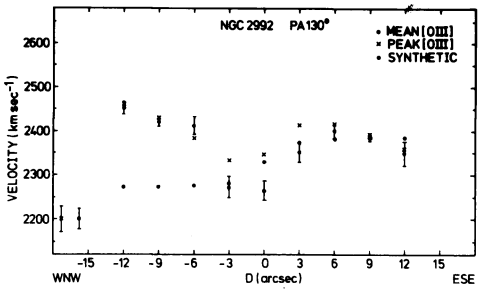


Fig. 1.
Image of NGC 2992 obtained by Dr. di Serego Alighieri on the light of redshifted [OIII]λ5007 Å. The position angles for long-slit spectroscopy are superimposed.

A number of conclusions can be drawn from the observations:
- A blue asymmetric profile is observed at the centre of the galaxy producing a blueshifted mean velocity, $V_{mean}-V_{sys}$ = -69 km s^{-1}, and a redshifted peak velocity, $V_{peak}-V_{sys}$ = +25 km s^{-1}. Recent models (Mardaljevic et al. 1986) explain this effect with the existence of both infalling and outflowing clouds interacting with an outflowing wind in the centre of active galaxies.
- While the observed velocity field at P.A. 26° - approximately the P.A. of the dust lane - has been successfully modelled with a normal rotation of the galactic plane, this is not possible for the other P.A.'s.
- As pointed out by Whittle (1985) there is a tendency for the edge-on Seyfert galaxies to show broader [OIII] emission lines indicating the presence of a turbulent medium or the existence of emitting gas in a disk not coaligned with the galactic plane. Our results on P.A. 340° and P.A. 310° (Fig. 2b,c) indicate the presence of an outflow (≈20 km s^{-1} $arcsec^{-1}$) which together with the observed broadening (FWHM≧200 km s^{-1}) supports the idea of an inclined disk in which the NLR resides. In this connection a conical outflow of gas has been recently discussed for nearby Seyfert galaxies (Wilson et al. 1985).
- The presence of a sinusoidal structure superposed on the velocity field at P.A. 130° and P.A. 160° (Fig. 2b,c) can be understood in terms of tidal forces (Toomre & Toomre, 1972) produced by the passage of the companion galaxy NGC 2993 which is located to the south at a projected distance of 25 kpc at P.A. 155°.

ACKNOWLEDGEMENTS: L. Colina, K.J. Fricke and W. Kollatschny achnowledge support of the DFG under grant Fr 325/21-4. L. Colina achnowledges





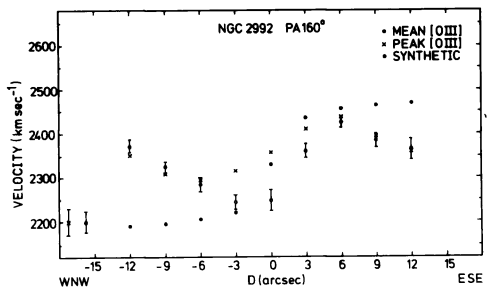


Fig. 2a,b,c
The observed velocity fields at position angles P.A. 26°, P.A. 130° and P.A. 160° as well as the synthetic rotation curve are presented in Fig. a,b,c.
See text for explanation.

the support of an ESA Traineeship. The authors thank Dr. di Serego Alighieri for obtaining the image of NGC 2992 in the [OIII]5007 line.

LITERATURE

Burbidge, E.M., et al. (1972) Ap.J. 178, L43
Di Serego Alighieri, S., et al. (1985) A.A. 149, 179
Heckman, T., et al. (1981) Ap.J. 247, 403
Mardaljevic, J., et al. (1986) M.N.R.A.S. 218, 651
Rubin, V., et al. (1985) Ap.J. 289, 81
Toomre, A., Toomre, J., (1972) Ap.J. 178, 623
Ulvestad, J.S., Wilson, A.S., (1984) Ap.J. 285, 439
Vrtilek, J.M., (1985) Ap.J. 294, 106
Whittle, M., (1985) M.N.R.A.S. 213, 33
Wilson, A.S., et al. (1985) Ap.J. 291, 627