

## EVIDENCE OF EXPANSION IN THE CENTRAL REGION OF NGC 2346

D.P.K. Banerjee, B.G. Anandarao, J.N. Desai  
Physical Research Laboratory  
Ahmedabad 380 009, India

S.K. Jain and D.C.V. Mallik  
Indian Institute of Astrophysics  
Bangalore 560 034, India

ABSTRACT. We present observations of the bipolar planetary nebula NGC 2346 carried out with the 1-m telescope at the Vainu Bappu Observatory in Kavalur, India using (1) a high resolution piezo-electric scanned Fabry-Pérot Spectrometer (with a velocity resolution of  $10 \text{ km s}^{-1}$ ) for line studies in the 6000 Å - 7000 Å spectral range and (2) a pressure scanned Fabry-Pérot spectrometer (with a velocity-resolution of  $5 \text{ km s}^{-1}$ ) in the green region. The nebula was observed in the H I 6563 Å and [N II] 6583 Å emission lines using a 15" aperture and in the [O III] 5007 Å line using an 8" aperture centered on the bright central spot. A number of scans in each of these lines were co-added to improve the signal-to-noise ratio. The [O III] profile shows a well defined split between the blue and the red component, typical of an expanding shell. The [N II] profile does not show a well resolved split, although a pronounced suggestion of a split was observed in all the scans. The H $\alpha$  profile was broad and asymmetric. The composite [O III] and [N II] profiles were decomposed into two individual Gaussians for obtaining the expansion velocity.

TABLE 1. EXPANSION VELOCITY

Emission Line	Expansion Velocity
[O III] 5007 Å	8 $1 \text{ km s}^{-1}$
[N II] 6583 Å	11 $1 \text{ km s}^{-1}$

A rough estimate of ion temperature was also made using the widths of the individual Gaussians in the [N II] and H I profiles. Assuming that the H I and [N II] lines originate from the same region of the nebula and that microturbulence is uniform throughout, we obtain temperatures of 7800 K and 14500 K respectively for the approaching and receding shells of the nebula. These temperatures may be compared with the electron temperature of 14200 K measured by Sabbadin (1976, *Astron. Astrophys.*, 52, 291) using the [N II] line ratio.