АСТРОФИЗИКА

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# AT THE 2.6 M TELESCOPE OF BYURAKAN PEROT-FABRY OBSERVATIONS OF GAS EMISSION IN NEBULAE WITH CIGALE

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During the summer of the year1985, the Perot-Fabry scanning interferometer CIGALE of Marseilles Observatory was installed at the prime focus of the 2 m 60 cm telescope of Byurakan Observatory. The long run (two new moons) was successful and gave matter to numerous publications.

1. *CIGALE instrument.* Cigale instrument is fully described in Boulesteix et al. (1983). It is basically a focal reducer in the parrallel beam of which a scanning Perot-Fabry interferometer is set. The detector is a Thomson photon-counting system device, which allows a time resolution of 1/50s and, as consequence, rapid scannings.

In order to avoid transparencies and seeing fluctuations, the basic scans must not exceed 10 minutes. Usually 24 to 32 channels are scanned, dependly of the Finesse of the etalons which are used.

In the focal plane, a narrow band interference filter is put, in order to isolate a band-pass of the same order of the free spectral range of the interferometer (~~10 Å).

At the 2.6 m telescope of Buyrakan, the usefull pupill on the interferometer was 35 mm and the final aperture ratio on the photocathode was f/1.9. The observed field was 256×256 pixels of 2.1 arc sec, so that the total observed field was 9'×9'.

The spectral resolution was 0.3 Å at $H_\alpha$ (R~20000).

The total efficiency of the instrument was estimated to 0.04 and the limit of detection for emission to $10^{-16}$ erg.s$^{-1}$.cm$^{-1}$.arcsec$^{-2}$ for a 2 hours exposure.

The scientific interest of such an instrument is to obtain simultaneously *imager* and *profiles* on a large field with an important spectral resolution. It is in fact ver well adapted to emission of inonized gas in galactic or extragalactic objects. Th observer can simultaneously get the narrow-band photometry and the velocity field

2. *Main published results of the 1985 run.*

- Hydrogen emission in the direction of h and $\chi$ Persei (Mirzoyan et al., 1991)

For the first time, this emission, apparently coming from the OB association wa detected. Several hypothesis for its origin are described in the paper of L. Mirzoya

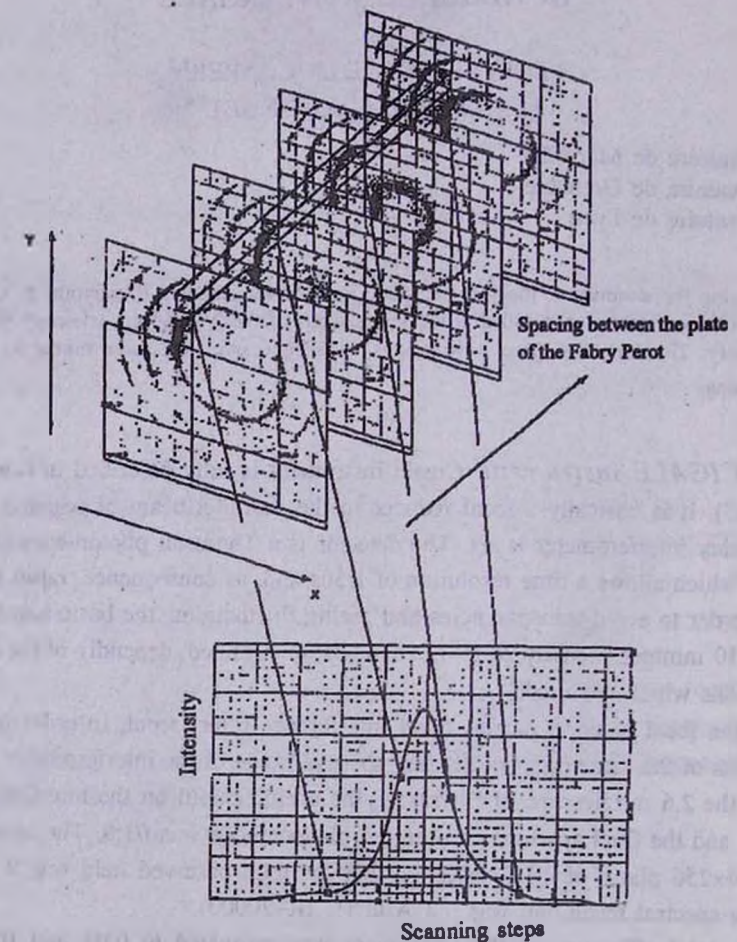


Fig. 1. CIGALE principle of scanning profiles

in these proceedings.

- W 58G: a distant HII region in the HI Cygnus arm (Georgelin et al., 1988) :

Four distinct nebular emissions can be distinguished along the same line of sight. Two are related to the nearby Cygnus complex, one at $V_{LSR}$=0 km.s$^{-1}$ is associated with the Cygnus Rift at 900 pc and another one at $V_{LSR}$=60 km.s$^{-1}$ is probably due to stellar winds or supernova remnants. The third emission, at $V_{LSR}$=-26 km.s$^{-1}$; is the optical counterpart of the Extented Region South East of W58 in the Perseus arm (8.4 kpc). The fourth emission commes from W58G, an HII region which appears to belong to the HI Cygnus arm, with $V_{LSR}$=-66 km.s$^{-1}$, at a distance of 12.4 kpc.

- $H_\alpha$ observations of the HH objects in the NGC 7129 field (Magakian et al., 1994):

$H_\alpha$ emission profiles of HH objects around NGC 7129 were obtained. HH 103 and GGD 35 have broad and double-peaked profiles. One extended arc-shaped HH object was confirmed. The shock velocities and orientation angles were computed.

- Kinematics of the ionized gas in the center of the Andromeda nebula (M31) (Boulesteix et al., 1987):

A very high contrast monochromatic image and a two-dimensional radial velocity field in the 6584 Å line of ionized nitrogen were obtained in the 3'×3' central part. The already known mottled appearance and the presence of 50-100 km.s$^{-1}$ chaotic

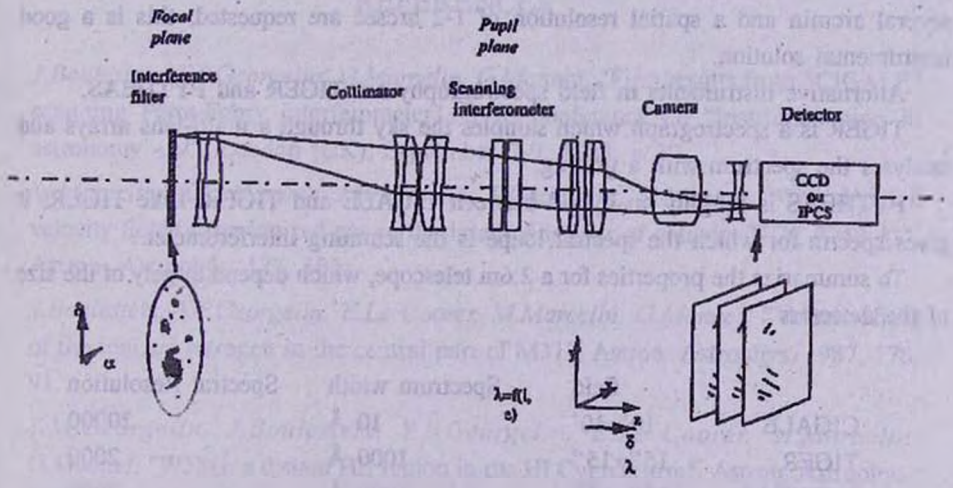


Fig. 2. CIGALE Perot-Fabry spectrometer.

motions were confirmed and connected to injection of kinetic energy in the interstellar medium via supernovae explosions.

- NGC 7752-53 (Marcelin et al., 1987):

More than 1800 velocity points over the whole galaxy and its companion were measured. Both galaxies are warped because of the interaction and the mass of each one was computed. Tidal model was developped.

- The HII regions and the velocity field of NGC 7331 (Marcelin et al., 1994):

47 HII regions of the galaxy were studied and main parameters as diameter, luminosity and velocities were derived. $H_\alpha$ luminosity function was computed. Velocity field reveals non-circular motions, like the classical wiggles of the isovelocity lines when crossing a spiral arm, or the Z shape distortions of the isovelocity lines in the center possibly revealing an unseen bar.

- Some data on IC 5283, a neighbour of NGC 7469 (Petrosyan et al., 1992):

The well-known Seyfert galaxy NGC 7469 was observed in $H_\alpha$ and [NII] 6584. The two arms of the galaxy differs in the star formation rates. The radial distribution of the hydrogen abundance and its mean value are typical of late-type spirals. No azimuthal variation in the nitrogen abundance or variation along a spiral arm could be put in evidence.

3. *Conclusions.* A scanning interferometer attached to a 2.6m telescope is a powerful tool to study the ionized extended gas. For all objects for which a field of several arcmin and a spatial resolution of 1-2 arcsec are requested, this is a good instrumental solution.

Alternative instruments in field spectrography are TIGER and PYTHEAS.

TIGER is a spectrograph which samples the sky through a multi-lens arrays and analyses the spectrum with a grating.

PYTHEAS is roughly an hybrid between CIGALE and TIGER. Like TIGER, it gives spectra for which the spectral loupe is the scanning interferometer.

To summarize the properties for a 2.6m telescope, which depend largely of the size of the detectors :

| | field | Spectrum width | Spectral Resolution |
|---|---|---|---|
| CIGALE | 10'×10' | 10 Å | 20000 |
| TIGER | 15"×15" | 1000 Å | 2000 |
| PYTHEAS | 15"×15" | 1000 Å | 2000 |

Scientific domains which can be studied with these instruments is large: physics

of HII regions, planetary nebulae, SNR, super-associations, HH objects, galactic structure, insterstellar medium, kinematics of nearby galaxies, bulges, bars and rings, dark matter, mergers, gas in ellipticals, BGC, AGN, Markarian and Seyfert galaxies, environment effects in clusters, other diffuse emissions.

## ПЕРО-ФАБРИ НАБЛЮДЕНИЯ ЭМИССИИ ГАЗА В ТУМАННОСТЯХ НА 2.6М ТЕЛЕСКОПЕ БЮРАКАНА С СИГАЛЕ

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В течение лета 1985г. Перо-Фабри сканнирующий интерферометр СИГАЛЕ Марсельской обсерватории был установлен в первичном фокусе 2.6м телескопа Бюраканской обсерватории. Длинный ряд наблюдений (два новолуния) был успешным и предоставил материал для большого числа публикаций.

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