THE PRODUCTION OF A 16-MM FILM OF M31

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INTRODUCTION

The high-resolution HI survey of M31 (Brinks, this volume) was made at a resolution of $\Delta\alpha \times \Delta\delta \times \Delta V = 24'' \times 36'' \times 8.2$ km s^{-1}. These measures comprise a data cube of 147 channel maps, each 1024 by 1024 pixels in size, and separated in velocity by 4.1 km s^{-1}. Interpretation of these data is hindered by the inability to quickly and easily peruse the maps. It is especially hard to see features which may be continuous along the velocity axis or along a single coordinate axis.

For these reasons we chose to make a record of the data set on 16-mm film. By viewing gray-scale representations of the radio maps at high speed (typically 12 frames per second), any continuity in the data would become manifest as a result of persistence of vision. Further, such a film would allow easy dissemination of the data to others.

HARDWARE DESCRIPTION

All data reduction was performed at Leiden Observatory (Brinks and Shane, 1983). The processed data were then brought to Groningen where they were displayed and photographed using the GIPSY image processing system (Shostak and Allen, 1980).

The GIPSY facility consists of an International Imaging Systems Model 70 image processor connected to a DEC PDP 11/70 host computer. The Westerbork data, compressed to maps of 512 x 512 or 256 x 256 pixels in size, were transferred from tape to disk for rapid access. Several PDP RPO 5 (88 Mbyte) disk packs were used for this purpose. Maps on disk could be quickly loaded into one of the Model 70's six 512 x 512 x 8-bit deep frame buffers for display. The analog video signal from the display controllers was also output to a video disk recorder, which had the capacity to store up to 300 monochrome images. The playback speed of the recorder was selectable from one frame per four seconds up to standard video rate (25 frames per second).

H. van Woerden et al. (eds.), The Milky Way Galaxy, 443–444.

For reasons of speed in production of the film, images were first loaded onto the (analog) video disk, and then photographed in real time upon playback. A once-per-frame synchronization pulse was output from the disk and used to drive a synchronous motor mounted on a Bolex film camera. Since exposure times were short (0.02 sec), a reasonably sensitive emulsion was demanded. We used Eastman type 7250 high-speed reversal color film, daylight type, which has an ASA index of 250.

DISPLAY CONSIDERATIONS

All maps had to be numerically scaled to the 8-bit range of the display memories. Since the dynamic range of the data was approximately 20 dB, this presented no problem. However, because of the transfer characteristics of the monitors, the range of displayed brightnesses was not 256:1 but rather 256^{γ}:1, where $\gamma \simeq 2.4$. Consequently, special software was employed to reduce image contrast by effectively taking the $(1/\gamma)$-th root of frame buffer values before display. The final printed film shows the full dynamic range of the data and has a resolution comparable to the original images.

FILMED SEQUENCES

The film primarily consists of three sequences, each of which shows the data cube along one of its principal axes. A sequence is repeated four to five times at a relatively high frame rate and then three times at a lower rate. The recordings are in black and white, as we feel it is easier to translate gray-scale levels into intensity levels, and because it appears less "noisy".

The first sequence shows the channel maps at full resolution, with a velocity range from -618.1 to -16.2 km s^{-1} in steps of 4.1 km s^{-1}, i.e. at half the velocity resolution. The second series consists of position-velocity maps, made along a line perpendicular to the major axis. The position-velocity maps were made after the channel maps had been smoothed to twice the original spatial resolution in order to enhance the extended low-level emission. The film shows this sequence of position-velocity maps, each separated by 0.6 arcmin, starting about 70 arcmin north of the nucleus. The last sequence comprises position-velocity maps made parallel to the major axis, also at 0.6 arcmin intervals, running from east to west of the nucleus.

The duration of the film is about 8 minutes. Copies may be obtained at cost (about 250 Dutch guilders) from E. Brinks.

REFERENCES

Brinks, E., Shane, W.W.: 1983, Astron. Astrophys. Suppl. (submitted)
Shostak, G.S., Allen, R.J.: 1980, in "ESO Workshop on Two-Dimensional Photometry" (ed. P. Crane and K. Kjär)