COOPERATION IN ASTRONOMY BETWEEN INDONESIA AND JAPAN

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Abstract. The cooperation programme in astronomy between Indonesia and Japan is presented as an example of a well-coordinated bilateral cooperation between Asian countries. This cooperation has started in 1979, in the fields of galactic astronomy and stellar physics. The form of the cooperation is principally the exchange of persons between both countries for the purposes of collaborative works in some specific fields, the training of young astronomers, and technical cooperation. The main subjects of collaborative works are: (1) survey of red giants in the galactic center region, (2) survey of Hα-emission stars in some areas of the sky, (3) theoretical study of the dynamical evolution of stellar systems, (4) photoelectric observations of southern close binaries, (5) X-ray binaries and pulsars, (6) Be stars, and (7) other topics. The organization and main results of these works are presented, along with a future aspect of the cooperation.

1. Introduction

The close relationship between Indonesia and Japan in the fields of galactic astronomy and stellar physics became realized in about 1975 after the construction of two Schmidt telescopes in Japan. They are the 40/70/120-cm Schmidt at the Ouda Station of the University of Kyoto and the 105/150/330-cm Schmidt at the Kiso Observatory of Tokyo Astronomical Observatory. At the Bosscha Observatory in Indonesia, the 50/70/127-cm Schmidt telescope was constructed in 1960, and since then, observational works by this telescope have been accumulated.

Based on the support of JSPS (Japan Society for the Promotion of Science) and DGHE (Directorate General for Higher Education, Ministry of Science and Education, Indonesia) the cooperation programme has started in 1979 under the title of Spectroscopic and Photometric Study of the Galaxy for the first three-year programme. The second three-year programme in 1982–1984 was extended to include stellar physics and adopted the general title of Galactic Structure and Variable Stars.

The form of cooperation is principally the exchange of persons between both countries for the purposes of carrying out collaborative works in some specific fields, training of young astronomers, and of technical cooperation. The number of astronomers mutually sent during the two three-year programmes are 20 (short period < 2 months) and 4 (long period 2 to 12 months) from Japan to Indonesia, and 9 (short period) and 6 (long period) from Indonesia to Japan. For the training of young astronomers, a number of lectures and colloquia has been organized in both countries, besides of some fellowships for


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longer study being afforded from the Ministry of Education, Science and Culture of Japan, or from other sources.

In the following sections we present main activities in the respective fields of collaborative works, and an aspect of future cooperation.

2. Galactic Astronomy

2.1. RED GIANT SURVEY IN THE GALACTIC CENTER REGION

Red giant stars which are luminous and sufficiently numerous in the galaxy can serve as an effective probe of the galactic center region, especially when observed in near-infrared spectral regions. K. Ishida, K. Hamajima, T. Ichikawa, B. Hidayat, and M. Raharto organized an extensive survey programme using the Schmidt telescope of the Bosscha Observatory with the 6° objective prism and R and I band photography. The observations have been carried out for the region $l = 350° - 10°$ and $|b| \leq 2°$ in 1979–1981, and several thousands of faint red stars were detected. Spectral classification and measurements of position, magnitude, and colours have been made for these stars. The main results of this work are as follows.

(a) The 2.4 $\mu$m infrared enhancement in the region $l = 355°$ and $b = -1°$ was explained as a characteristic of the galactic window (Hamajima et al., 1981, 1982).

(b) A map of interstellar extinction up to about 5 kpc toward the galactic center region was derived (Ichikawa et al., 1982a).

(c) Red giant stars detected in the survey were compiled to a catalogue of M-type stars by Ichikawa et al. (1982b) and Raharto et al. (1983).

(d) Two large dark cloud complexes were found in the region $l = 351°$ to $1°$ and $|b| \leq 2°$ (Ichikawa, 1984).

2.2. SURVEY OF H\alpha-EMISSION STARS

The survey work of H\alpha-emission objects by the Kiso Schmidt telescope with the 4° objective prism conducted by Maehara (1981) and by Ogura (1984) have been extended to the southern sky at the Bosscha Observatory (Maehara, 1982; Ogura and Hidayat, 1986). Ogura and Hidayat (1986) have found a weak association between Bok globules and emission-line stars in their survey of 24 regions around Bok globules.

The survey of the CMa OB1/R1 complex region has been conducted by Kogure and Wiramihardja using the Kiso Schmidt telescope with the 4° objective prism and 128 H\alpha-emission stars have been detected in total, among which 77 were new ones. A two-colour diagram was constructed for these stars (Wiramihardja et al., 1986).

2.3. DYNAMICAL EVOLUTION OF SPHERICAL STELLAR SYSTEMS

The dynamical evolution of spherical stellar systems such as globular clusters has been a subject of the collaborative work of S. Kato, S. Inagaki, and P. Wiyanto. They have approached this problem by numerically solving the Fokker–Planck equation and examined the following two points: