

ASTRONOMY IN INDONESIA

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I. INTRODUCTION

According to Hins (1950) three main causes gave way to found an observatory on the island of Java. The first was the need to open up the southern sky for astronomical research. Up to the 20's a large number of observatories were located in the northern hemisphere. It was thus felt necessary to have more southern stations with which modern astronomical observations could be pursued and frontiers could be pushed.

The second reason was the enthusiasm of Dr. J. G. E. G. Vouté, a civil engineer-turned-astronomer. His interest in double-star astronomy was aroused when he was appointed observer at the Leiden Observatory.

Last but not least, is the stature of Mr. K. A. R. Bosscha, then the administrator of a flourishing tea estate in Java. He was the most influential non-astronomical factor which helped to shape astronomical observatory in the tropics. A complete account of Bosscha has been extensively reviewed by van der Hucht and Kerkhoven (1982).

Those were the three factors which paved the way for the foundation of the "Dutch East Indies Astronomical Association" in 1920, whose primary task was to build an observatory and, to promote progress of astronomical science in the colony. When the observatory was still in statu nascendi Prof. van de Sande Bakhuysen, then retired Director of the Leiden Observatory, donated his fine and extensive collection of books. These were to become the core of the Bosscha Observatory library which, thanks to the Leids-Kerkhoven-Bosscha-Foundation, is still maintained as an important astronomical library.

In 1928, the 60-cm double refractor, of Carl Zeiss (see Vouté, 1933) was completed. Besides the photographic observation of visual double star, several other works were conducted at the Bosscha Observatory. Prof. Pannekoek of Amsterdam (1928) spent several months at the observatory to extend his milky way mapping which was started earlier for the northern sky.

Other astronomers active at Lembang in the 20's and early 30's were Paul Ten Bruggencate of Göttingen, Germany and E.A. Wallenquist of Uppsala, Sweden. Ten Bruggencate studied globular clusters and carried out photometric and spectroscopic studies of variable stars. Wallenquist did theoretical works and investigated some southern galactic clusters by means of their colors and studied the distribution of stars. E. A. Kreiken from the Amsterdam School of Astronomy was there to conduct theoretical studies of physical double stars and general distribution of stars in the Milky Way. Wallenquist (1939) described the good weather condi-

tion prevailing at the Observatory. Kreiken did not stay long at the Observatory. After the 2nd World War he became head of the Department of Higher Education in Jakarta. Besides Vouté and the three scientists already mentioned above, G. Simonov participated in observational program from 1936 on. In 1939, Dr. A. de Sitter and Dr. Chr. Martin, both of the Leiden school of astronomy, came to join the staff of the observatory. Due to age, Vouté was replaced by Dr. A. de Sitter.

In 1943-1945 Masasi Miyadi, then a young Japanese army captain, who later, became Director of the respectable Tokyo Astronomical Observatory, was in charge of the Bosscha Observatory under the Japanese military government. His presence saved the observatory from improper treatment that might otherwise have taken place. According to his account (1975) he was responsible for putting Vouté back to work in Lembang rather than staying in a prisoner camp because of his administrative ability.

The Second World-War and subsequent conflicts were disastrous to the observatory. Not only did three leading members of the staff perish, but also many instruments were found to have deteriorated. Hins (1950) who was in Indonesia to restore the observatory, together with Poldervaart, of the Army Triangulation Brigade and H.P. Berlage, the Director of Meteorology and Geophysics Institute in Jakarta charted the necessary steps to put the observatory into effective use again. It took almost three years to rehabilitate the observatory. By August 1949 photographic observations could be resumed. Dr. Elsa van Dien and Dr. G. B. van Albada took charge of the observatory. Within the constraints of time and situation they decided to continue the double star observation and laid down plans for the 50's. In this period Iwan Nikoloff of Bulgaria (now at Perth, Australia) joined the staff and conducted some double-star observations. Mr. Santosa Nitisastro served as an assistant astronomer.

II. EDUCATION OF ASTRONOMY AND THE NEW TELESCOPE

The importance of teaching astronomy at the university level was realized as far back as 1948. The idea received the attention of the Dean of the Faculty of Mathematics and Natural Sciences, of the University of Indonesia, Prof. M. Th. Leeman. He made the necessary arrangements to transfer the observatory from a private institution into the university confine. In October 1951 the observatory was officially transferred to the Faculty of Mathematics and Natural Sciences (later to become the Faculty of Mathematics and Natural Sciences of the Bandung Institute of Technology), and Dr.

G. B. van Albada was made its first Professor of the Department of Astronomy. That was the beginning of an association with the university which would ensure the supply of astronomers. It was also for the first time that Indonesia incorporated a curriculum of astronomy in its tertiary level of education.

The model of astronomical education was derived from the Dutch system of education in which the first three years leaned heavily on courses in physics and mathematics. Only after the student passed successfully his first three years could he embark on real astronomy courses. The later part of his study took about 2 to 2.5 years. This system of education persisted until the early 60's, when the tertiary education in Indonesia became more inclined to the Anglo Saxon mode. This system made it possible for a student to obtain first his bachelor, and, subsequently, a master or doctoral degree. Realizing the isolated position of Lembang, as far as astronomy is concerned, we encouraged young graduates to obtain a higher degree in astronomy abroad. This practice allows younger colleagues to experience contact with a wider circle of activities and thus hopefully to avoid "inbreeding."

A new direction of research started in 1959 when the new Schmidt-type telescope ($f/3.5$, 51 cm) became available to the observatory. The telescope came into being through a UNESCO project that was started in 1951 by van Albada. The optical parts were prepared at the Yerkes Observatory of University of Chicago under the supervision of Dr. G. P. Kuipers, a former Leiden astronomer. The mechanical parts contracted by the Indonesian government with the engineering firm Rademakers, in Rotterdam, under the supervision of Ir. B. G. Hooghoudt of Leiden. The assembly adjustment and testing were completed successfully by Dr. V. M. Blanco of the Case Institute of Technology and by Dr. Pik-Sin The. Officially inaugurated on May 28, 1960, the telescope was used immediately to survey H-emission-line stars in the direction of the galactic center. Pik-Sin The (1961) gave an elaborate description of the new telescope. The telescope is equipped with a 6°-objective prism, with which spectroscopic work can be conducted, giving the dispersion of 312 Å per mm. It serves as a good instrument for galactic structure research. Van Albada-van Dien (1995) gave an account of the birth of that telescope.

III. INTERNATIONAL CO-OPERATION AND THE FUTURE

In 1963 an international symposium on "Stellar Photometry and Spectral Classification" was hosted by the Institute Teknologi Bandung. The meeting was under the general supervision of Prof. Pik-Sin The. In 1973 the IAU entrusted Indonesia to organize an IAU School for Young Astronomers. Similar activity were organized again in 1983, which was held in conjunction with the 60th Anniversary of the Bosscha Observatory and the 1983 Solar Eclipse. Prof. Wentzel, the Univer-

sity of Maryland, gave a very valuable advice in this matter.

Indonesia became a member of the International Astronomical Union in 1979 thanks to efforts of the late Prof. Edith Muller, Prof. Blaauw and Prof. C. de Jager. In 1981 Indonesia organized the Second Regional Asia-Pacific Meeting on Astronomy. This meeting, which was attended by over 115 astronomers, discussed the problems of Galactic Structure, Extragalactic Astronomy, Binary and Variable Stars and Education on Astronomy. To commemorate the both anniversary of the Observatory the IAU sponsored a Colloquium (No. 80) on Double Stars, with emphasis on physical properties and generic relations. The Leids-Kerkhoven Bosscha Foundation of the Netherlands supported the commemoration.

Another aspect of cooperation in astronomy was the work of Indonesia and Japan which was started in 1978 (see Kogure and Hidayat 1985). With the help of the JSPS, The University of Kyoto and the University of Tokyo some Indonesian astronomers obtained their Ph.D in various fields of astronomy in Japanese Universities in the 80's.

A Dutch-Indonesian cooperation in Astronomy is established in the framework of the "Indonesian-Netherland Astrophysics" (INA). Four main research areas have been adopted in the co-operative work: (1). Visual binaries. (2) Spatial distribution of the hottest and coolest stars. (3). High- and low-energy astrophysical studies of evolved massive binaries. (4). Shock waves and particles in curved space time corresponding to plasma and condensed media. With this umbrella of cooperation Indonesian students have had the opportunity to work study in the Netherlands to obtain higher degrees in astronomy.

The Indonesian community of astronomy is naturally looking forward to new hardware projects, which would enable them to expand their activities and research. A new 45-cm telescope was commissioned in 1989, obtained through the Indo-Japan project. The telescope is dedicated for photometry of close binary stars and spectroscopy. Thanks to the efforts of Profs. Kitamura, Kogure and Ishida to secure this telescope.

van der Hucht (1984) suggested a 2.5-meter class telescope. The now temporary shelved project was the meter radio telescope to be founded in the equatorial Sumatera (Swarup, Sukumar and Hidayat, 1984). In 1996 Ratag of LAPAN started a feasibility study to found a larger telescope.

Training of professional astronomers is offered at the Department of Astronomy, Institut Teknologi Bandung. The curriculum at the department is linked with the curriculum at the Faculty of Physics and Mathematics. The students begin to study astronomy after they have attended the common first-year at the Institute. At the second year, astronomy students take 4 credits (which is equivalent to 4 class hours per week) of astronomy classes, out of 18 credits per semester.

The fourteen other credits include 2 credits of civics and Mathematics and Physics. In later years, the 2 credits in civics remain unchanged but the credits for astronomy courses gradually increases. The courses include: Cosmology, Galactic Structure, Binary Stars, Solar Physics, Solar Systems.

Astronomy as part of physics is also given at some other universities and Teacher Colleges across the country. The instructors in the later institutions have usually acquired their knowledge of astronomy in the post-graduate courses that are provided by the respective institutions. At the Teacher College at Bandung, astronomy must be taken by those who are attending the postgraduate training of education in physical sciences. The program not only employs one of the astronomers, but also uses the facility of the Observatory. Astronomy is also given at secondary schools. Up to about 2 to 4 hours a week, usually in the context of earth and space sciences. It is only natural to state here that there is a varying degree of depths and intensities in the ways the teachers teach their students.

Astronomy has found its place in Indonesia. Hidayat (1995) gave a review of the needed cooperation in order to elevate scientific capability in the Asia Pacific Regions. Indonesia has technically three astronomy research facilities and one tertiary-level teaching institution for astronomy. Altogether there are now 20 astronomers. With this in mind we welcome international cooperation to promote astronomy in Indonesia.

For general problems institutions located at strategically geographic points can cooperate and combine their resources to: (1) observe objects which show transient and time dependence variation. (2) search and survey for discovery certain type of objects.

Nowadays many large telescopes are increasingly employed for extragalactic research, but there are still many galactic objects within the reach of smaller telescopes. These include, for example:

1. Galactic structure
 - (a) study and characterization of planetary nebulae
 - (b) the structure and kinematics of small H II regions
 - (c) study of dark nebulae to obtain distances and other physical characteristics of nebulae, linked with information from other wave-length regimes
 - (d) study of star forming regions in Bok globules and GMC
 - (e) ascertain the nature of star groupings, in relation to the theory of cluster dispersal
2. Studies of some selected close and visual binaries.
3. Variable-star surveys and individual studies of variable stars.

4. Statistics of near-space fast-moving-objects and comets.

IV. DESIDERATA

Transfer of technology would also mean the transfer of science and culture. This, in turn, will help to create the competitive advantages. In order to fill scientific gaps between countries cooperative efforts should promote scientific manpower developments. They will become the valuable components to ensure the endurance of astronomy cooperation. While technical cooperation is an important aspect, one should also produce endowment for the future of astronomy so that there exist sustainable development in science. Astronomical problems for regional cooperative efforts should have scientific merits, in the sense that the result of cooperation add to the existing treasure of knowledge.

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