Amateur Astronomy in Hong Kong

— A Brief History —

By Alan Chu

Abstract: Hong Kong is a city on the southeastern coast of China. Its stargazing activities are traceable to the 1940's beginning with Joseph Liu, a pioneer amateur astronomer. This paper gives a short history of the early development, the biography of Joseph Liu and his memorial story about comet watching. It then describes the public astronomical organizations, their contributions and the local publications in chronological order. The last sections highlight the individual cases of research and the equipment used by the Hong Kong amateurs. Web links are provided to pursuit a particular subject.

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(More pictures in CD-ROM)

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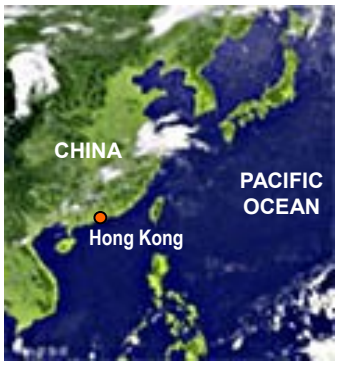
Section 1. The Early Years

Hong Kong is a city on the southeastern coast of China, at about 114^0 E and 22^0 N. It was a British colony since 1842 but was returned to China in 1997. It has 1000 square kilometers with seven million inhabitants, 90% are Chinese and the rest is a mix of international cultures.

Figure 1.1



The amateur astronomers in Hong Kong are minorities. Yet their activities are traceable to over 60 years ago. On 21 September 1941, a native young boy, Joseph H. C. Liu, learnt his first lesson of astronomy by watching the solar eclipse. During 1942 to 1945 when the Japanese took over Hong Kong by war, lighting was suppressed and the sky became very dark; the boy's quest for astronomy was enriched by learning stars and constellations through his mother. In 1951, Joseph Liu obtained his first astronomical telescope from his parents. It was an American-made 3.5-inch (9cm) Newtonian reflector. Figure 1.2 shows this telescope and Joseph Liu in old Chinese tradition. He is standing in front of a star chart and holding a copy of the *Sky & Telescope* magazine. Owning a telescope and subscribing foreign magazines were luxurious in those days, but Joseph's parents were open enough to support their son. The first telescope did not fulfill the demanding Joseph. In 1953, he obtained his second telescope, a 6.5-inch (16.5cm) f/10 Newtonian reflector equipped with gravity driving-clock, astrograph and micrometer. "It was a second-hand telescope, so lengthy, heavy and weapon-look that it was strictly inspected by the police on its way home." recalled Joseph Liu.[3b] Nevertheless, the second telescope lasted well and was his "Old Faithful" until he finished the study of Mars opposition in 1971.

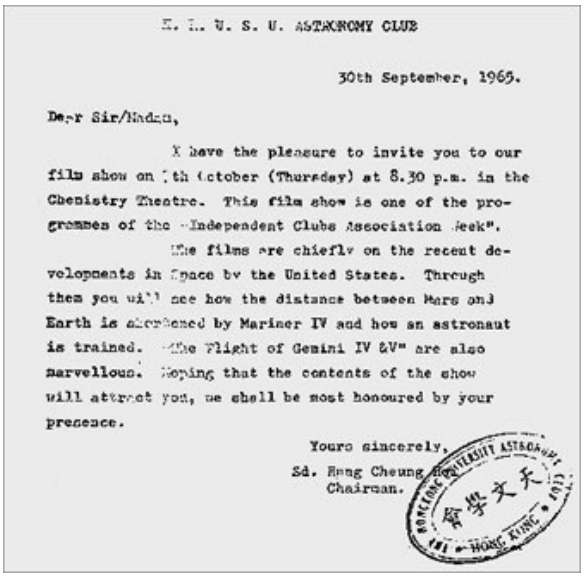
Figure 1.2 - Joseph Liu & his first telescope, 1951

The popularity of stargazing in the territory was kindled when the Student Union of the University of Hong Kong established its astronomy club in 1958 [7b]. The club promoted summer astronomy classes and film shows to the secondary school students. The promotion was attractive, due to public attention to the first Russian satellite (*Sputnik I*) launched in 1957, pursued by the American satellite (*Explorer 1*) next year. The launch of planetary

Figure 1.3

probes (*Mariner 2 & 4)* to Venus and Mars in the early 60's enhanced the public interest in space. The school students were most fantastic among all citizens. The local science magazines, aiming at student readers, posted beautiful drawings of the celestial objects and spaceships in every monthly issue (Figure 1.5). The City Hall Public Library, opened in 1962, had a fairly good collection of reference books in astronomy and space science. Similar books were published by the "Red China" through the translation of Russian literatures. In 1961, the Queen's College established the first secondary school astronomy club. In 1969, the Chinese University of Hong Kong established the New Asia Astronomy Club.(4) On the other hand, individual amateurs continued to develop their own observational skills and resources. Figure 1.6 shows the early works from the author of this paper. For the casual stargazers, they generally referred to the constellation maps in the South China Morning Post, the best-selling English newspapers in the territory. ***Click here for a constellation map***.

Figure 1.4 - A letter from Astronomy Club of the University of Hong Kong, 1965



U. U. U. S. U. ASTRONOMY CLUB

30th September, 1965.

Dear Sir/Madam,

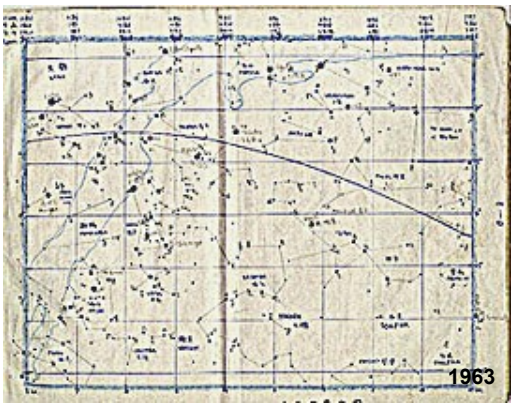
I have the pleasure to invite you to our film show on 7th October (Thursday) at 8.30 p.m. in the Chemistry Theatre. This film show is one of the programmes of the "Independent Clubs Association Week".

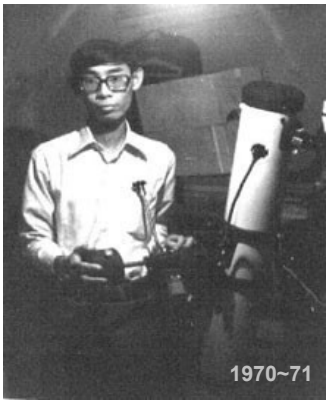
The films are chiefly on the recent developments in Space by the United States. Through them you will see how the distance between Mars and Earth is shortened by Mariner IV and how an astronaut is trained. The Flight of Gemini IV &V" are also marvellous. Hoping that the contents of the show will attract you, we shall be most honoured by your presence.

Yours sincerely,
Sd. Hung Cheung
Chairman.

Figure 1.5 - Two science magazines published in Hong Kong in 1960 ~ 61

Figure 1.6 - (Left) A star map drawn by the author of this paper in 1963. Total 5 pages to cover the whole sky, with stars up to magnitude 4. Hand drawn because copying machine was not invented at that time. (Middle) Astronomical tables in 1964; logarithmic values are given alongside to facilitate calculations. (Right) The author's second telescope, a 100mm f/10 reflector. His first telescope was built from eyeglass lens, 30X magification.





Besides science magazines, a number of astronomy books, now becoming classics, were known to the Hong Kong amateurs in the 60's. They include the author's collection in Figure 1.7, and the following titles. (8)

- Celestial Objects For Common Telescopes
  by T. W. Webb
- Norton's Star Atlas & Telescopic Handbook
  by Arthur P. Norton and J. Gall Inglis
- Amateur Telescope Making
  by Albert G. Ingalls
- How to Make A Telescope
  by Jean Texereau
- All About Telescopes
  by Sam Brown
- Telescopes for Skygazing
  by Henry E, Paul
- Astronomy Handbook
  by G. D. Roth
- Atlas of Deep-Sky Splendors
  by Hans Vehrenberg
- Lunar Atlas
  by Dinsmore Alter
- Guide to the Moon
  by Patrick Moore
- The Moon
  by H. P. Wilkins & Patrick Moore
- Foundation of Astronomy
  by W. M. Smart
- Astronomy (college text book)
  by R. H. Baker

Figure 1.7 - A collection of books published in 1933 ~ 67. Book 1 is a translation from Japanese, it is the first book that fueled the astronomy interest of the author of this paper.

1 - 19 : 天空的神秘'33 * 星空巡禮'47 幾顆著名的星'54 * 清朝天文儀器解說'56 天文學習題和練習彙編'56 * 新星和超新星'57 * 趣味天文學'57 * 小行星'57 * 怎樣利用日月星晨找方向'58 中國古天文學'59 隕星和流星'59 行星際的旅行'60 * 少年天文學家'60 * 日月交食基本理'60 揭開火星的秘密'61 Astronomy Entertainment '58 * Radio Astronomy '62 大眾天文學'65 * 宇宙壯觀'67 * *(* translated version)*

Science-fiction movies from Hollywood motivated public interest in astronomy too, the most memorial being

- The Day the Earth Stood Still 1951
- Flight to Mars 1951
- The War of the Worlds 1953
- Forbidden Planet 1956
- Journey to the Centre of the Earth 1959
- The Time Machine 1960
- 2001, A Space Odyssey 1968

Figure 1.8 - Hollywood Movies

(*Left to right)* Flight to Mars; The War of the Worlds, based on H. G. Wells' novel about a Martian invasion; The Time machine, also from H. G. wells' novel; 2001, A Space Odyssey.

Click here for more movie posters

Click here for a video clip of ***2001, A Space Odyssey.***

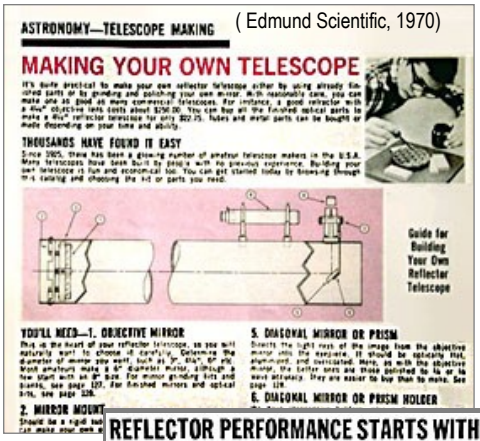
By 1969 when the American astronaut Neil Alden Armstrong put his footprints on the Moon, a number of observing sites were established by the active stargazers. The best known is the Yuen Long site (Figure 1.9). The site was indeed primitive and by no means an observatory at all. Yet much of the fundamentals, such as star-hoping and polar alignment, were learned there using refractors as small as 6cm (2.4") aperture. Those refractors were imported from Japan, with focal ratio of f/15 to cut colour aberration, no polar scope, no driving motor, and priced twice of a technician's monthly salary. The more aggressive observers, however, preferred to grind mirrors from glass plates dismantled from the ships' windows. (Hong Kong had a large *Taikoo Dockyard* in the 60's, and hardware from ships were easily available in the market called *Canton Road*). Newtonian reflectors of 15 to 25cm (6 to 10 inches) aperture were common in amateur telescope making. Some bought the mirror kits from Edmund Scientific Co. or Cave Optical Co. in the United States (Figure 1.10). The Yuen Long site was the nursery of the older generation observers. It was, however, abolished in the mid 80's due to town re-development.

Figure 1.9 - Yuen Long site, 1971 ~ 72

Astro images from Yuen Long site

Astrograph, home-built by an active stargazer at Yuen Long site

Figure 1.10 - Advertisement from two American mirror suppliers



(Edmund Scientific, 1970)

Cave Optical, 1972

In Section 3, the history after 1970 is presented in chronological order. Meanwhile, the next Section focuses on Joseph Liu, a pioneer amateur astronomer who has been introduced earlier.

Section 2. A Pioneer Amateur Astronomer

I learned this poem about 63 years ago, while I was in kindergarten. It was this lively poem that kindled my interest in the stars and the Moon. Throughout all these years, it has given me so much inspiration and often aroused my nostalgia. I am 69 years old now, and I still love this sweet little poem so dearly.

(Joseph Liu, March 2001)

The early history of amateur astronomy in Hong Kong is largely marked by the passion of Joseph H. C. Liu (廖慶齊 in Chinese), especially in the field of astrophotography and his services in the popularization of astronomy. This Section focuses on his biography, followed by his comet story.

2.1 Biography of Joseph Liu [5]

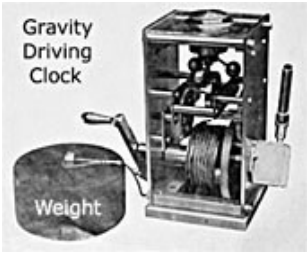
Mr. Joseph Liu was born in Hong Kong in 1931. His love of astronomy started very early when he was a boy living in rural Hong Kong. He earned his Bachelor of Arts degree from the University of Hong Kong in 1961.

Mr. Liu taught Chinese literature and Chinese history at the Queen's College where he was subsequently promoted to Vice Principal. He remained with the Queen's College until 1971 when he became Principal of the Sha Tau Kok Government Secondary School located in rural Hong Kong. In 1974, the then Urban Council sought Mr. Liu's assistance in the establishment of a planetarium, which later became the Hong Kong Space Museum. The Hong Kong Space Museum opened in 1980 and was the first fully automated planetarium in the world. Mr. Liu was appointed as its first Chief Curator until 1985 when he retired and settled in California. Mr. Liu has been promoting astronomy since the very early days. From 1966 to 1977, Mr. Liu was a part-time lecturer at the University of Hong Kong Extra-Mural Studies, teaching observational astronomy. Many local active stargazers have been his students.

Mr. Liu has always been a very enthusiastic stargazer and astrophotographer. His first set of astronomical equipment was the 9cm (3.5”) f/11 Newtonian reflector. The 16.5cm (6.5”) f/10 Newtonian reflector, imported second-hand from England in 1953, was his second telescope. This telescope was very important to him, as it was "fully" equipped with a gravity-driving clock, astrograph, illuminated guiding telescope and a Browning Micrometer for measuring double stars.

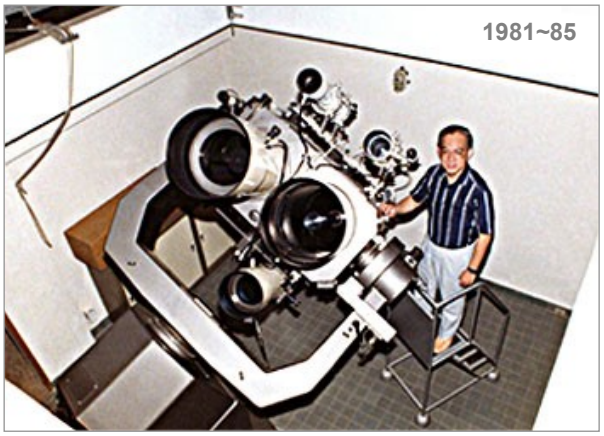
Through the high optical quality of the 6.5-inch Newtonian, Mr. Liu obtained many detailed photographs of the planets and the moon.

Figure 2.2



In 1972, he built a sliding roof observatory at the backyard of his ancestral house in rural Hong Kong. The observatory housed an Optical Craftsman 32cm Newtonian-Cassegrain (f/5 & f/19) reflector riding on a heavy-duty Hong Kong-made cross-axis mounting with an oversized Byers gear. Mr. Liu and his observatory were featured on the cover of the April 1974 Issue of Sky & Telescope.[1a] With the 32cm reflector, Mr. Liu obtained highly detailed lunar and planetary images for which he was awarded the first and third prices in the astrophotographic competition organized by the Astronomical League in 1977. In 1980, he donated the entire 32cm telescope setup to the Physics Department of the University of Hong Kong.

Figure 2.3 - Joseph Liu and his observatory in Hong Kong



In 1981, Mr. Liu rebuilt his ancestral house along with his sliding roof observatory which was moved from ground level to the second floor. His new telescopes were a pair of catadioptrics, a Celestron C14 SCT and a Japan Special Optics 25cm Wright-Schmidt astrograph, riding side by side on a Goto fork mount of his design. Before he retired in California in 1985, the whole set of telescope found a new home in the Science Museum of Guangzhou which had a similar latitude of Hong Kong for the fork mount.

In respect of his public recognition, in 1982, Mr. Liu was given the Chiro astronomical award in Japan. Also in 1984, he was bestowed with an MBE (Most Excellent Order of the British Empire) honour. Both awards were given to Mr. Liu in recognition of his contribution in the promotion of popular astronomy in Hong Kong. At the backyard of his Californian residence, Mr. Liu built his existing sliding roof observatory which currently houses the Astro-Physics 20cm Starfire refractor and the 30cm Astromak astrograph. His major astronomical interest, apart from lunar and planetary photography, remains to be the observation of variable and double stars.

In April 1998, the International Astronomical Union approved naming asteroid 6743 Liu (1994 GS) as proposed by the discoverers K. Endate and K. Wantanabe following a suggestion by A. Fujii and T. Sato.

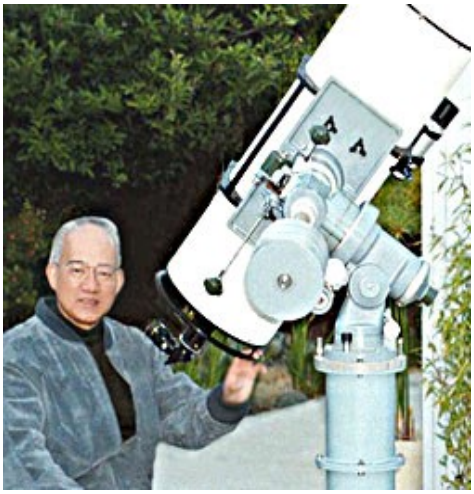
In spring, 1969, Mr. Liu and his wife Julia paid a visit to Professor Syotaro Miyamoto in Japan. Professor Miyamoto was Head of the Astronomy Department of the University of Kyoto, and the Director of the department's Kwasan Observatory. Professor Miyamoto was a world-famous planetary astronomer, and specialized in the research of the Planet Mars.

Figure 2.4 - Joseph Liu's backyard observatory in California.

Figure 2.5 - Prof. Clyde Tombaugh and Joseph Liu

The left photo was taken at the office of the late Professor Clyde Tombaugh (1906-97) in the Astronomy Department of the University of New Mexico. In the summer of 1973, after spending about a week in observing Mars with Charles Capen (famous Mars observer and astronomer) at the Lowell Observatory in Flagstaff, Arizona, Mr. Liu went to Las Cruses, New Mexico to visit Professor Tombaugh who was the discoverer of the Planet Pluto in 1930. During his several days' stay in New Mexico, besides using the department's 24-inch very long focus Cassegrain to photograph Jupiter, it was Mr. Liu's privilege to observe Jupiter visually together with Professor Tombaugh and his wife, Mrs. Patsy Tombaugh, through their homemade 40cm (16") Newtonian telescope erected at the backyard of his home. They had a most pleasant evening under the starry sky. It was something never to be forgotten!

Figure 2.6 – Joseph Liu in home California



Click here for more pictures.

Mr. Liu and his wife are currently living in California.

2.2 The Comet Story

Now comes Mr. Liu's comet story. It is not only amusing; it also reflects an amateur's passion for the night sky, and the nostalgia of the days when astronomical equipment were not yet shaded by today's digital technology.

---------- *THE COMET STORY by Joseph Liu* ----------

I am not a comet hunter or not even an experienced comet observer. I just have a casual interest to watch or attracted by the sights of such celestial wanderers or sudden visitors whenever they happened to be around or were on their way coming towards near our Mother Earth.

During my 50 or more years of sky watching, I have seen several bright and famous comets, plus quite a few of the less significant ones. Of all these visitors, perhaps three of them have given me (to myself at least) either sweet memory or some quite amusing and unique experiences.

- ***Comet Arend-Roland in 1957***

When I was young (in my teen), I often heard or read about comets but without having seen one or knew what they really were. About a year after I got married, my dear wife Julia and I heard that a new comet was discovered in Belgium by two professional astronomers Arend and Roland. The month of May in Hong Kong, as you may expect, is often cloudy, and sometimes with heavy rain. We tried to search the sky with a pair of 8x30 binoculars for several evenings, and finally caught sight of it in the constellation of Camelopardalis. That was the first comet we had ever seen. In the '50s, we didn't have light pollution problem, especially in the New Territories (Sheung Shui Village) where we lived. Comet Arend-Roland was fairly bright, between magnitude 2.5 and 3 which was "bright" in the evening sky in a rural area. The "young couple" (age 25 & 24) were so excited that they set up their telescope on the roof to photograph the celestial visitor. As I said earlier, it was the first comet we saw in our life, and it was also the very first comet that we successfully recorded on film. The pictures of the Comet and the "Young Couple" (Figure 2.7) are attached herewith for sharing. These pictures had also appeared in the South China Morning Post, Sing Tao Evening News and I think also Wah Kui Yat Poa. The telescope was a 16.5cm (6.5-inch) f/10 Newtonian, and the camera had a lens of 10cm (4-inch) aperture. By the way, the telescope was equatorially mounted and equipped with a "driving-clock" which was not run by electricity but by gravity with the help of two fly-balls and pulled by heavy lead weights. We had to wind the "clock" about every 10 minutes in order to keep the telescope running (tracking), so our 50-minute exposure of the comet photo required at least to be wound five or six times, and before each new winding, we had to cover up the camera lens, and after each winding, we had to check the position of the comet on the cross-hair of the guiding eyepiece before we opened the

lens cover again. Despite all these tedious "formalities" we got the picture, and it was a pretty good one. We doubt if we, the old couple, could do it again now, but we were young in 1957!

Figure 2.7 - (Left) Comet Arend-Roland (C/1956 R1), captured by Joseph Liu and his wife Julia in 1957 at their home village in Hong Kong. (Right) The *Young Couple* and their 16.5cm f/10 Newtonian reflector.

- ***Comet Bennett in 1970***

The second comet I wish to narrate here is the Comet Bennett in 1970. From 1961 to 1971, I worked at Queen's College, Hong Kong. At the latter part of my teaching career at Queen's, I was the school's Second Master (Vice-Principal). Due to heavy school duties, I spent my observing time more in the urban area rather than my home village in Sheung Shui. So when the news of the discovery of a bright comet by John C. Bennett, and amateur comet hunter in South Africa reached Hong Kong, I wanted to be first one in town to capture the spectacle (See, I was then still quite "young" and ambitious!). The next early morning, therefore, you found me roaming in the huge lawn of the Kowloon Hospital because I could have a wide open sky there without any soul to disturb me at about 4 a.m. I brought along with me a pair of 7x50 binoculars (already up-graded from the old 8x30!), Norton’s Star Atlas, finder charts, a flash-light cover with red cloth, note-pad and other necessary gadgets. It was the first day of April, the early morning sky was unusually clear and tranquil. Oh! What a wonderful environment to look for the comet, and it was very convenient for me to go there as my home (a flat) was right opposite the hospital. It took me less than 10 minutes to walk across the street and strolling up to the hospital's big lawn which was about 50 feet above the Argyle Street. All the way, I was looking up and enjoying the beautiful sky without paying attention to things that were around or near me. Then all of a sudden, I felt a sharp pain on my back, plus a blinding flashlight shinning on my face. There were two men seemed to come out from nowhere and who actually had followed me all the way once I entered the hospital compound. While one of these strong men still pointing my back with a

wooden pole that had, I later found out a sharp metal head, a dangerous weapon; the other stronger fellow caught my two arms and shouted at me saying that I was under arrest. They said they FINALLY caught me because there had been many recent burglaries in the doctors' living quarters there, and I must be the guy responsible for that! They also mentioned that what a fool I was, because they had followed me all the way and I didn't even notice that they were behind me. Of course, I was hardly aware of their stalking as I was paying so much attention to the starry sky and was anxious to locate the new comet. It took more than half an hour for me to explain my purpose to be in the government properties, and told them that I was also a civil servant like themselves. They then searched me, kept on questioning me and looked at my Norton's Atlas (I wished they could understand the contents!), yet I had a hard time to convince them the flashlight with the red cover. Since they failed to find any weapon from me, they let me go very reluctantly, with the real burglar was still on the loose. What a BIG "APRIL FOOL" I was. I shouldn't trespass. It was really my fault. Well, I was not welcome in the city, so I went back to my home village in Sheung Shui (the Liu clan) where I had my faithful 4-inch astrograph with which I took this picture. Here it is (Figure 2.8).

Figure 2.8 - Comet Bennett
(C/1969 Y1)

Date: 1970 April 03

Time: 21:08 ~ 21: 20 UT

Lens: Ross Portrait 400mm f/4 (same lens as Comet Arend-Roland was shot)

Film: Kodak Tri-X Professional (ASA 320)

Exposure: 12 minutes

- ***Comet Hyakutake in 1996***

My other favorite comet is a comet of recent years ---- Comet Hyakutake. I understand that not too many people in Hong Kong saw this beautiful intruder owing to the unfavorable sky condition during its appearance. I was fortunate enough to witness it in the more transparent and drier sky in California, although end of March is normally the last part of the rainy season here, and the weather is usually still quite unstable. I packed my instruments which consisted of a 300mm f/4.5 Nikkor telephoto lens and a Takahashi Epsilon-160 f/3.3 astrograph together with a Takahashi T-90 equatorial mount and headed my way to Fremont Peak (only 2,800 ft elevation) which is one-hour driving from my home in Salinas, a small farming community, about 100 miles south of San Francisco. Frankly speaking, I was too ambitious as far as equipment is concerned. Comet Hyakutake was actually not a big comet, but it was very close to us, it appeared to be long, very long, and it moved fast. I spent two nights in the mountain, it was cold and at times humid.

Although I was well dressed for the weather and for this pretty visitor, it was not really that comfortable to observe and to spend the nights on top of a cold mountain or peak. Yet, it was a very worthy trip. Well worth for all the preparation and to carry the rather heavy gears there and to tolerate the cold. Why?

i) Comet Hyakutake was the longest, although not the brightest comet I have ever encountered. I estimated its length to be about 30~35 degrees visually, yet other amateurs that night claimed that their estimates were 40 degrees or longer. One younger astrophotographer who set up near me told me his measurement was 60 degrees or a little more! Most likely, my own estimate was somewhat too conservative because of my aged-eye sight, but I just want to be honest, for this is science.

ii) Comet Hyakutake was the bluest comet I have ever seen. The blue color was so subtly beautiful that it was beyond my ability to give a faithful description.

iii) On March 24, 25 when I spent the nights in the mountain, Comet Hyakutake made her appearance on the meridian and near the zenith around or after mid-night. To me that was rare, and because of its high elevation, it helped to "open" itself fully and grandly. Blue, bright, thin, long and tenuous. Again, the beauty is beyond my description. What a WONDERFUL sight, and a sight of never to be forgotten!

iv) On the first night, while I was doing the final check up on my equipment for the job, two young men appeared. CHINESE! Who could they be? When they looked at me, "Ha! Another CHINESE"?! Then they called aloud: "Liu Sir"! Guess what? They were Queen's College old boys, and I could hardly recognize them!!! They just completed their graduate studies on computer from Stanford University, one was a Ph.D., the other was a Master. See, for astronomers, the Earth is really a very small world. On top of this big surprise, they had a whole range of lenses with them, and they lent me one of their shorter focal length (wide-angle) lenses for me to get a more complete picture of the Comet Hyakutake. Without their kind help and courtesy, the picture of Comet Hyakutake (Figure 2.9) would not be here. And it was wonderful that the Comet brought the teacher and old boys together again!

Figure 2.9 - Comet Hyakutake (C/1996 B2)

Date:1996 March 24
Time: 08:15 ~ 08:25 UT
Lens: 35mm f/4
Film: Kodak Royal Gold 1000
Exposure: 10 mins.

To sum up, I think Comet Arend-Roland was the comet that brought me the most sweet memory, because my beloved wife, Julia was with me to catch our first comet. The "Comet Bennett Incident" is something that is not easy to forget. Comet Hyakutake was the most beautiful comet that I have ever witnessed in my life. It was not the brightest. I love it because of its subtle beauty.

Joseph Liu

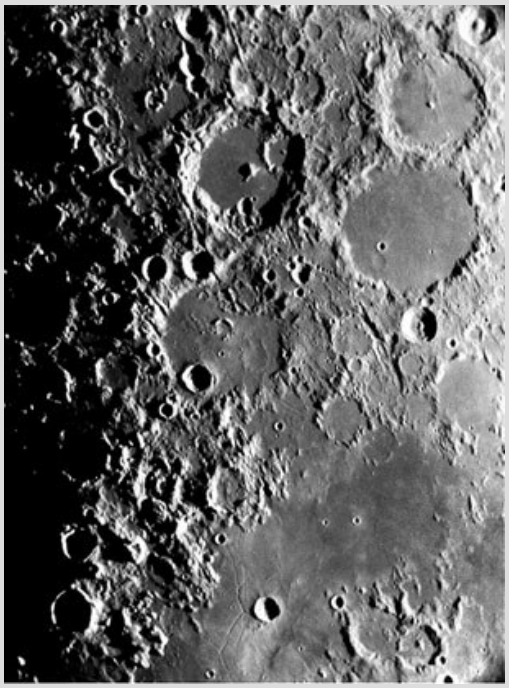


Figure 2.10 - Images by Joseph Liu in Hong Kong

Left: Ptolemaeus & the vicinity (the Moon), 32cm f/19 Cassegrain, PL25mm eyepiece, Kodak Plus-X film, 1/2 sec exposure, 1972.08.30.

Right: The Swan Nebula M17, Celestron C14 at f/7, deep-sky filter, Kodak TP2415 (hypered film), 60 min exposure, 1984.07.22.

Remark: 1. The astro gallery of Joseph Liu is available on website http://liu.hkas.org.hk/
2. An interview with Joseph Liu in 1990 is given in "Astronomical Researches in Hong Kong, Volume II ". [3b]

Section 3. Astronomical Activities

The Year 1970 is special because it marks the establishment of the Hong Kong Amateur Astronomers' Union, the first public astronomical organization in the territory. Its founders were some twenty stargazers in Yuen Long site (see Figure 1.9 of Section 1). It was renamed twice and finally settled in 1992 as the Hong Kong Astronomical Society. The Society is the largest astronomical body in Hong Kong, with more than 400 members at present. Three similar public bodies follow; they are

- the Sky Observers' Association, established in 1972.
- the Space Observers Hong Kong, established in 1979.
- the Astronomical Workshop, established in 1994.

Besides above, there are two subsidized organizations that promote popular astronomy:

- the Hong Kong Space Museum,
  established by the Hong Kong Government in 1980, opened to all citizens.

- the Ho Koon Nature Education and Astronomy Centre,
  established by Sik Sik Yuen in 1995, opened to schools and communities only.

The Hong Kong Space Museum is characterized by a planetarium dome of 23m diameter. The Ho Koon Nature Education and Astronomy Centre is equipped with an observatory dome of 6m diameter in which a computerized 0.5m (20") Ritchey-Chrétien telescope is housed.

Figure 3.1 - The Hong Kong Space Museum

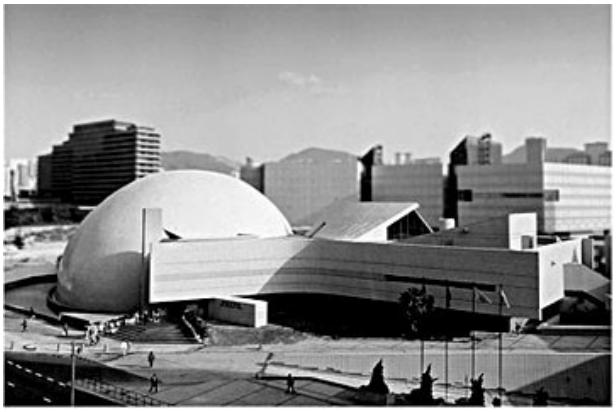
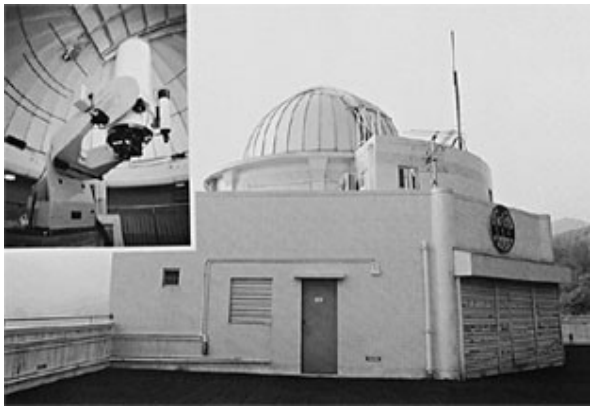


Figure 3.2 - The observatory in Ho Koon



The followings are the activity highlights of these organizations and some important personal works in chronological order.[4] [8]

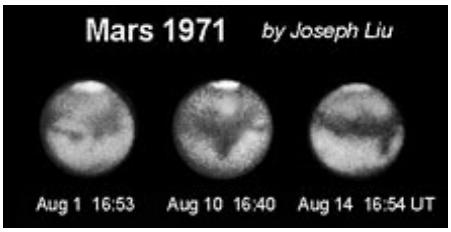
3.1 From 1970 to 2001

Figure 3.3

1970

- The Hong Kong Amateur Astronomers' Union was established but not yet registered. It published monthly stencil-printed "Astronomy Information" and dispatched them free to members and astronomy clubs in secondary schools.

Figure 3.4



1971

- Many amateur observed Mars in opposition.
- A series of Mars images was captured by Joseph Liu in Hong Kong using his 16.5cm (6.5") f/10 reflecting telescope. The images showed a large ice cap but diminishing in size at the south pole of the planet.

1972

Figure 3.5


The extramural class of astronomy, 1972

- Large scale observation of total lunar eclipse.
- Joseph Liu built the first private observatory in Sheung Shui Village, Hong Kong. The observatory housed a 32cm (12.5") Newtonian-Cassegrain reflector.
- The Sky Observers' Association (SOA) was established by the students from the extramural astronomy course of the University of Hong Kong.[6b]
- The Hong Kong Polytechnic (now Hong Kong Polytechnic University) established its astronomy club.
- Observed Giacobini meteor shower.
- The sunspot data since 1970 was studied by the Hong Kong Amateur Astronomers' Union. It was found that major earthquakes tended to happen two days after large groups of sunspots passed the sun's central meridian. The finding was submitted to the Purple Mountain Observatory of China.
- The Yuen Long site of the Hong Kong Amateur Astronomers' Union was equipped with 25cm (10") reflecting and 10cm (4") refracting telescopes.

1973

- The University of Hong Kong offered undergraduate courses in astrophysics.
- The SOA introduced monthly stargazing camps and published its journal "Sky Observers' Digest".

Figure 3.6

1974

- An observation report was prepared jointly by 18 secondary schools after observing Comet Kohoutek (C/1973 E1) for 3 months.
- Joseph Liu served as an advisor to plan the building of the Hong Kong Space Museum.
- The Chinese University of Hong Kong established its astronomy club.
- The Hong Kong Amateur Astronomers' Union was renamed "Hong Kong Amateur Astronomical Society (AAS) and registered formally the same year.
- The AAS and SOA jointly published the stencil-printed "Hong Kong Astronomical Journal". The publication, however, was taken over by the AAS in 1976 and ceased in 1981 due to reforms of policy. Thirty-four issues were distributed in 5 years time.

1975

- The AAS organized the first "Astronomical Photographic Competition and Exhibition" in the City Hall. More than 10,000 people visited this exhibition.
- Observed Nova Cygni (V1500 Cygni).

Figure 3.7

'75 Exhibition in the City Hall

1976

- The AAS and the Urban Council jointly Organized "Popular Lectures on Astronomy".
- Observed Comet West (C/1975 V1).
- The AAS and the SOA jointly conducted a survey of light pollution in Hong Kong.

1977

- The AAS hosted the "Astronomy Mailbox" in the local magazine *World of Science and Technology.*
- The AAS organized the first Hong Kong Astronomical Convention.
- The AAS hosted monthly a page about astronomy in the local press *Wah Kui Yat Poa*. The page lasted 13 years, a total of 169 issues.
- The AAS and the Urban Council jointly organized two exhibitions: the "Astronomical Essay Competition and Exhibition" and the "Astrophotographic Competition and Exhibition" in the City Hall, each attracting 40,000 visitors.
- The AAS published the "Hong Kong Astronomical Journal" in offset-printing instead of stencil-printing.
- The SOA published "Seasonal Star Chart" and the booklet "Lunar Eclipses".

Figure 3.8

First HK Astronomical Convention

Figure 3.9

Wah Kui Yat Poa

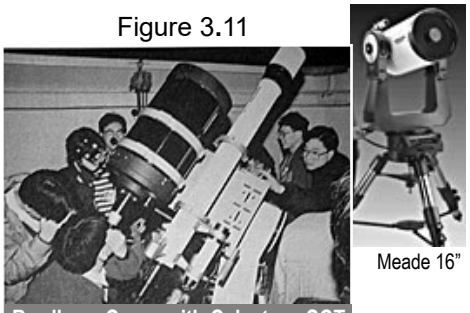
Figure 3.10

SOA publications

1978

- The AAS published the "Lunar Eclipse Handbook" for sale to the public.
- The AAS published a set of star charts up to 5th magnitude for its members.
- The AAS organized "Astronomy Study Camp" for leaders of various local secondary schools and community centres to share their experience in managing astronomical groups.
- The AAS was invited as the advisor in Bradbury Camp of the Boys' and Girls' Clubs Association of Hong Kong. In 1985, the Camp installed a Celestron 28cm (11") Schmidt-Cassegrain and a 10cm (4") refracting telescope. In 2001, the camp installed a Meade 40cm (16") Schmidt-Cassegrain.

Figure 3.11



Meade 16"

Bradbury Camp with Celestron SCT

1979

- The Space Observers Hong Kong was established by the readers of the local magazine *World of Science and Technology.* (6c)
- The SOA (Sky Observers' Association) organized "Astronomy Lecture Series" with the Urban Council for the first time.

1980

Figure 3.12

Solar eclipse expedition to China

- The Hong Kong Space Museum (HKSM) was opened to the public. It included a theatre, an exhibition hall and a planetarium that housed the first OMNIMAX film projector in the eastern hemisphere. Since then the HKSM has become the most important local educational institution for popularizing astronomy.(6e)
- The AAS and SOA members made their first total solar eclipse expedition to Yunnan, China.
- The AAS rented a flat in the Western District which served the dual-role as office and observing station in the urban area.
- The New Asia College Observatory was completed and equipped with a 30cm (12") reflector. It was upgraded to the New Asia Observatory in 1999.

Figure 3.13

SOA - mirror grinding

1981

- The SOA built a 30cm (12") reflecting telescope.
- The SOA organized the first "Astronomical Observation Award Scheme" to promote the atmosphere of conducting astronomical research.
- The HKSM's "Solarscope" and the "Solar Hall" were opened.

1982

Figure 3.14

- The Astronomy Club of the University of Hong Kong published the first issue of the Hong Kong Astronomical Almanac". Its publication was later taken over by the Almanac Research Group.
- The HKSM published its first astro-calendar.
- The AAS established the Occultation Timing Section, promoting a research activity suitable for urban observers. The Section also dispatched information on impending occultation events of the Moon, satellites of Jupiter and asteroids.
- The AAS hosted the "1982 Hong Kong Astronomical Convention".
- The SOA started to release astronomical information to the local press.

1983

Figure 3.15

Broadcast "Cosmic Journey"

- The AAS and Radio Hong Kong cooperated to present a series of half-hour broadcast program "Cosmic Journey". A total of 34 sessions were presented.
- The HKSM installed a multi-language system (Cantonese, Mandarin, English and Japanese) for its Space Theatre programme.
- Members of the AAS observed total solar eclipse in Indonesia.

1984

- The AAS published a series of exercises for astronomical observation. Trainees were certificate-awarded after satisfactory completion of these exercises.

1985

- A SOA member imaged Comet Halley. He was the first amateur in China, including Hong Kong, to capture this comet with his own equipment.
- The AAS and Radio Hong Kong cooperated again to present broadcast program “Cosmic Journey II”.
- The HKSM and AAS jointly published the book “Comet”.

1986

- The Hong Kong Post Office designed a set of stamps to celebrate the 1986 return of Comet Halley.
- Wong Hin-fan, the president of the SOA, published the book “Introduction to Astrophotography”, the first of this kind in Hong Kong.
- The AAS organized “Astronomical Leadership Training” course. It aimed on management and astronomical skills required by a leader in organizing stargazing activities.

Figure 3.16

1987

- The SOA and the HKSM jointly organized the “Astronomical Observations Award Scheme Competition”. It attracted more than 400 participants.
- The AAS hosted the “1987 Symposium on Recent Researches in Hong Kong”. About 100 amateur and professional astronomers joined the function. The proceedings of this event were published in 1989. Similar proceedings were published in 1992 to 1997. (3)
- Hong Kong amateurs imaged solar prominences successfully during the September 1987 annular solar eclipse in Shanghai, China.

Figure 3.17

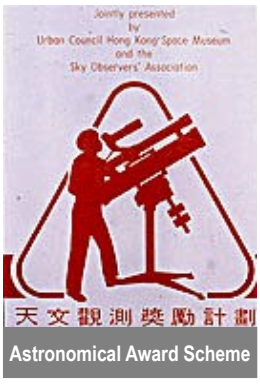
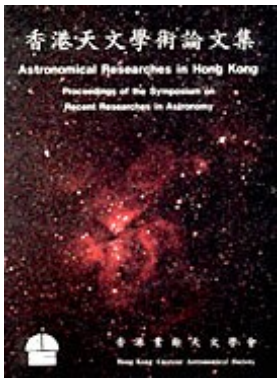


Figure 3.18 - (left) 1987 Symposium; (right) Proceedings



1988

- Lady MacLehose Holiday Village started to arrange weekend stargazing activities.
- The AAS became the Southeast Asia coordinator of the International Occultation and Timing Association (IOTA) for the collection and distribution of lunar occultation information.
- The AAS set up the Bulletin Board System “Astronet”. It was opened to the public, providing astronomical news and computer programs.

1989

- An AAS member presented his paper "Global Earthquake Time Sequence and Bi Bian-Bao Model". It was presented again orally in the "Astronomy and Natural Disasters Conference" held in Tianjin, China in 1991.
- The AAS hosted the "1989 Astronomical Symposium", with about 120 participants from Hong Kong as well as visitors from Mainland China, including astronomers from the Purple Mountain Observatory.

Figure 3.19

1989 Symposium

1990

- The SOA acquired a flat in Cheung Sha Wan District as permanent office.
- The AAS rented a deserted public primary school in Pik Uk and invested HK$100,000 on it as the Society's "Pik Uk Astronomical Education Centre". The school was returned to the Government in 2001.
- An AAS member proposed his hypothesis "Hong Kong was An Impact Crater".
- The AAS's Meteor Section successfully detected meteor showers using FM radios.

Figure 3.20

1991

- The AAS's Celestial Kinematics Section successfully converted the "Guiding Star Catalogue for the Hubble Space Telescope" to floppy disk format which contained star maps up to 16th magnitude for research purpose.
- The AAS's Occultation Section became the 1139th substation of the NASA's Artificial Satellites Observation Programme.
- The AAS invited two experts on impact craters from China to collaborate on research of impact craters in the territory.
- The AAS hosted the "1991 Astronomical Symposium".
- The AAS donated telescope accessories and occultation information to five amateur astronomers in China.
- The "China Aerospace Technology Exhibition" was held in Hong Kong, attracting 100,000 visitors.

Figure 3.21

China Aerospace Technology Exhibition

1992

- The Hong Kong Amateur Astronomical Society (AAS) was renamed Hong Kong Astronomical Society (HKAS).[6a]
- The Chinese University of Hong Kong introduced its general education course in astronomy to the undergraduates. Now more than 400 students enrolled the course each year.
- The Chinese University of Hong Kong organized the "astronomy workshop" for secondary school students. The activity culminated with the establishment of the 4th local public astronomical association "Astronomy Workshop" in 1994.

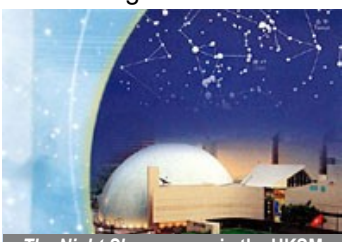
Figure 3.22

A class of "astronomical workshop"

1993

- The HKSM launched "The Night Sky", a program to learn seasonal constellations under the simulated night sky in its theatre. The Night Sky program is still continued today.
- The Astronomical Society of the Pacific authorized the HKAS to translate its quarterly "The Universe in the Classroom" to Chinese. About 1800 copies per issue were dispatched to local schools and astronomical bodies.
- Dobsonian reflectors from 25cm (10") to 44cm (17.5") aperture were available in the HKAS's Pik Uk Astronomical Education Centre.
- The HKAS hosted the "1993 Astronomical Symposium".
- The HKAS assisted the Department of Physics of the University of Hong Kong to repair the 32cm (12.5") Newtonian-Cassegrain telescope donated by Joseph Liu.

Figure 3.23



The Night Sky program in the HKSM

Figure 3.24

Robotic telescope demo in '93 Symposium

1994

- The HKSM organized its first large-scale exhibition "Our Time in space".
- The HKSM organized its outdoor observation activity that allowed visitors to observe through telescopes the impact of Comet Shoemaker-Levy 9 (D/1993 F2) with Jupiter.
- Astronomical Workshop was established by graduates from the Chinese University of Hong Kong. It visited many astronomical research organizations in China.(6d)
- The SOA set up its own Bulletin Board System "Skyweb".
- The University of Hong Kong introduced its first general education course in astronomy "The Nature of the Universe". Now over 600 students enrolled the course per year.
- Professor Cheng Kwong-sang of the University of Hong Kong was awarded the "National Science Prize (3rd grade) of China in recognition of his research in the mechanism of pulsar radiation.
- Space Observers Hong Kong established the "Cheung Po Observation Station". So far it has attracted over 7000 visitors.
- The HKAS's Occultation Timing Section was authorized by the International Occultation and Timing Association (IOTA) to compute and dispatch predictions of occultation events to India, China, Mongolia and Southeast Asia countries.

1995

- The SOA published the electronic astronomy magazine "Sky Vision" for the first time.
- The HKAS and the Space Observers Hong Kong set up their webpages.
- The Ho Koon Nature Education and Astronomical Centre was opened. It cooperated with the HKAS to provide astronomy courses and stargazing to high school students every Wednesday night.(6f)

Figure 3.25

Figure 3.26

Stargazing at Ho Koon

1996

- The Hong Kong University of Science and Technology introduced its first general education course in astronomy. In 1997 and 1998, it began to offer two undergraduate courses known as “Introduction to astrophysics” and “Black Holes and the Early Universe” respectively.
- The University of Hong Kong hosted the “21st Century Chinese Astronomy Conference” which was attended by over 200 Chinese astronomers.
- Space Observers Hong Kong provided concession membership to those who received Comprehensive Social Security Assistance.
- Local amateurs taking deep-sky photographs outside Hong Kong began to get popular.

Figure 3.27 (3d)

1997

- Local amateurs observed Comet Hale-Bopp (C/1995 O1) in Hong Kong, as well as in Taiwan and Yunnan, China.
- The HKSM and the SOA set up their webpages.
- The Hong Kong University of Science and Technology hosted the "Pacific Rim Stellar Astrophysics Conference". About 200 attendants.
- The HKAS members made Dobsonian telescopes from 0.2m to 0.5m (8" to 20") aperture.
- Astronomy Workshop established the "Draco Observatory" in Yuen Long which housed a 30cm (12") reflecting telescope.

Figure 3.28

Making Dobsonian telescopes

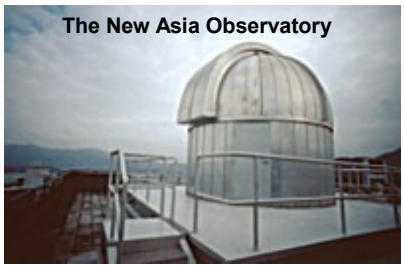
1998

- Asteroid Liu (No. 6743) was named after Joseph Liu, the first Chief Curator of the HKSM and also an amateur astronomer.
- The Ho Koon's 0.5m telescope was used to study the T Taurus variables. This was a joint project by the Yunnan observatory of China, the Ho Koon, and the HKAS.
- The HKSM broadcast the 22 August partial solar eclipse over the Internet.
- The Leonid meteor shower on 16 November provoked thousands of observers causing serious traffic congestion across the territory. Leonid pictures by Hong Kong amateurs were posted by NASA.[7d]

Figure 3.29

1999

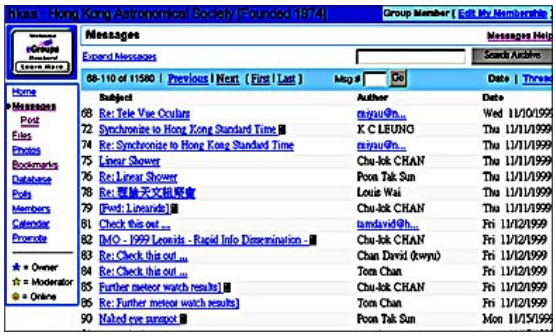
Figure 3.30



- Asteroid No. 3297 was officially named “Hong Kong”.
- The New Asia Observatory in the Chinese University of Hong Kong was established. It was equipped with a Torus 40cm (16”) reflecting telescope.(7a)
- The University of Hong Kong hosted the “Stellar Astrophysics Conference”. About 100 attendants.
- The HKAS hosted the “1999 Astronomical Convention”.
- The HKAS and Radio Hong Kong presented broadcast program “Unlimited Universe”.
- The HKAS published a comprehensive “Member’s Handbook” and established its bilingual (English / Chinese) astronomical discussion group in the Internet. The discussion group was opened to all its members and non-member subscribers as well. (2)

Figure 3.31

Figure 3.32 - HKAS Discussion Group



2000

Figure 3.33

- The Department of Physics of the University of Hong Kong and the HKSM jointly published the self-learning educational CD-ROM “Nature of the Universe”.
- The Chinese University of Hong Kong launched the educational webpage “Astroworld” and implemented the “Cosmic Ray Telescope” project.(7a)
- Wong Lung, the ex-president of the SOA, published the book “Making Astronomical Telescope” in the Internet.(7c)
- Ten HKAS members jointly rented an observing site in Taipo.
- A large-scale “China Aerospace and Technology” exhibition.
- The HKSM organized “Astrophotographic 2000 Competition”.

2001

Figure 3.34

- The January total lunar eclipse was broadcast over the Internet by the HKAS.
- Mars opposition in June was imaged extensively by digital technique using 8 - 14” (20 - 35cm) catadioptric telescopes.
- The Leonid meteor shower in November was observed by many amateurs in different sites all over Hong Kong, but it was less spectacular than the 1998 Leonid meteor shower.
- The HKAS, SOA and Space Observers Hong Kong jointly investigated the light pollution problems in the territory.
- Taikoo City Plaza and the HKAS jointly organized an astronomical exhibition.
- The HKAS acquired a new permanent office in Kwun Tong District.

3.2 Local Publications

Reference books published in Hong Kong are not many. Most local readers choose their books from foreign publishers. The *Sky & Telescope* (USA), *Temmon Guide* (Japan) and *Tianwen Aihaozhe* (northern China) are well-known imported magazines. **Click here for their pictures.**

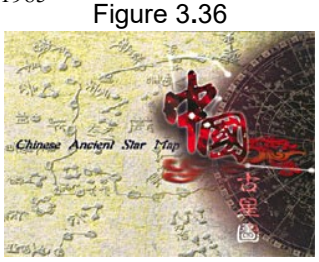
Below is a survey of the local astronomical publications in bookstores. The publications are in Chinese language except the last five items, which are presented in English and Chinese. (8)

Books

- Astronomy for Entertainment (趣味天文學, 蘇聯 Y. Perelman 原著，香港上海書局出版), 1957
- Meteorites and Meteors (隕石和流星，香港上海書局出版), 1959
- Ancient Chinese Astronomy (中國古天文學，香港中華書局出版), 1959
- The Radio Universe (射電天文淺說，真知出版社出版), 1971
- Ionosphere and Radio Waves (電離層與無咊電波，香港萬里書店出版), 1971
- A Brief History of Astronomy (天文學簡史，法國 G. de Vaucouleurs 原著，香港萬里書店出版), 1972
- Zhang Heng, the Ancient Chinese Astronomer (張衡，香港上海書局出版), 1972
- Astronomy: Questions and Answers (趣味天文問題，香港萬里書店出版), 1972
- Lunar Eclipse Handbook (月食觀測手冊)
  published by the Hong Kong Amateur Astronomical Society, 1978
- The Hong Kong Astronomical Almanac (香港天文年曆，李華聰編)
  published yearly by the Almanac Research Group since 1982
- Astro-calendar (天文月曆) published yearly by the Hong Kong Space Museum
- Relativity in Simple Language (白話相對論，錢誌思、鄺立三合著), 1983
- Introduction to Chinese Science & Civilization (中國科技史概論，何丙郁、何冠彪合著), 1983
- Comet, Its Characteristics & Observing Skills (彗星:性質及觀測方法)
  published by the Hong Kong Space Museum & the Hong Kong Astronomical Society, 1985
- The Stars (恒星) published by the Hong Kong Space Museum, 1985
- Introduction to Astrophotography (天文攝影入門，黃衍蕃著), 1986
- Astronomical Researches in Hong Kong (香港天文學會論文集)
  Volume I to IV, published by the Hong Kong Astronomical Society in 1989-97
- Love of the Night Sky (夜空之戀，李逆曙著), 1991
- Astronomical Exercises, 2nd Edition (天文觀測習作:第二版)
  published by Hong Kong Astronomical Society, 1999
- Astronomical Observation from 2001 to 2010
  (和星空有個美麗約會: 2001 - 2010 年天象奇觀的觀測與攝影，周俊豪著，香港萬里書店出版), 2001
- New Astronomer (天文觀測實用指南，英國 Carole Stott 原著，香港萬里書店出版), 2001
- Chinese Ancient Star Map (中國古星圖) bilingual, published by the Hong Kong Space Museum, 2002

Figure 3.35
Almanac

Figure 3.36



Chinese Ancient Star Map

Multimedia

- The Planets (日月星宿)
  a set of 8 VCD, bilingual, licensed by BBC Worldwide Ltd., 2000
- Stephen Hawking's Universe (霍金漫遊宇宙)
  a set of 6 VCD, bilingual, licensed by BBC Worldwide Ltd., 2001
- Nature of the Universe (宇宙的本質) a bilingual CD-ROM,
  published by the University of Hong Kong & the Hong Kong Space Museum, 2001
- Space (宇宙無限) a set of 3 VCD, bilingual, licensed by BBC Worldwide Ltd., 2002

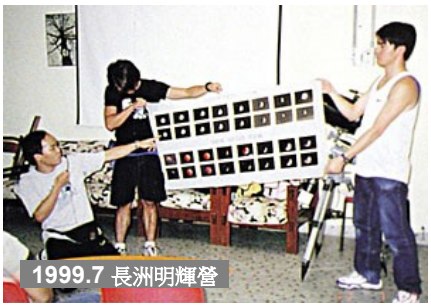
Figure 3.37

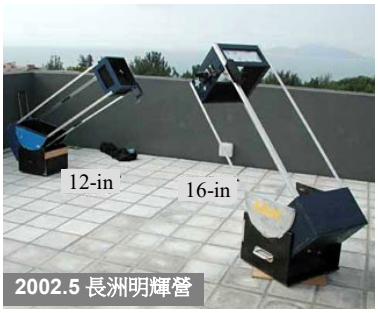
CD-ROM

3.3 Star Parties, Lectures and Sky Shows

Apart from the books, members of the local astronomical societies learn through newsletters or communicate over the Internet. The public can gain hands-on training from the star parties, normally held in rural sites by individual astronomical societies on monthly basis. A star party usually has 40 to 100 participants; meals and accommodations are arranged for overnight.

Figure 3.38 - Star party activities





Click here for more pictures. More 2 More 3 More 4 More 5 More 6 More 7 More 8

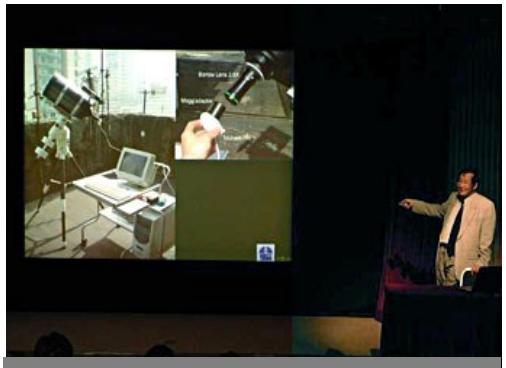
The public can also visit the Hong Kong Space Museum (HKSM) for lectures and sky shows. Scheduled courses are sometimes available in the Ho Koon Centre. See figures below.

Figure 3.39 – Lectures in the HKSM

Figure 3.40 - A sky show in the HKSM

How to manage an astronomy club, 2001

Talks on cosmology, 2001



Introduction to digital astro imaging, 2002

Began from	Title of the sky show [6e]
1983	Space Tomorrow
	Black hole
1984	Cosmic Flight
1985	The Return of Comet Halley
1986	The Universe of Dr. Einstein
	Star of Christmas
1987	Wonders of the Heavens
	The Moon Enigma
1988	The Story of Stars
	Wonders of the Worlds
1989	The Cosmic Perils
1990	Passport to Mars
1991	Destination Universe
	The Enigma of Time
1992	Questions
	From Fiction to Science
1993	The Voyager Encounters
	Eyes in the Sky
1994	Comet Crash
	Moonlanding - 25 Year On
1995	Voyage to the Galaxy
	Venus - The Unveiling Story
1996	Cosmos in the Wheelchair
1997	Comets of the Century
	Dragon in the Sky
	Mars: The Quest for Life
1998	Hunting Asteroids
1999	The Legend of Neutron Stars
	Spacetime Travel
2000	Enigma of the Sun
	UFO Files
2001	New Frontiers of Space Exploration
	Ancient Chinese Astronomy

More 2 More 3 More 4

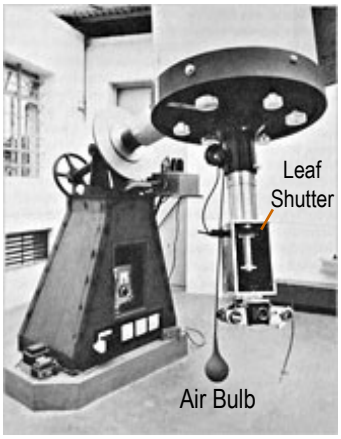
Section 4. Researches

Some fifty years ago when the local stargazers were still learning, astronomical researches were simply literature digest, modification of equipment and exploration of astrophotography. After the mid 60's, astronomy and space science penetrated in wider basis; the scope of research was extended to the analyses of observational data, applications of technology, environmental surveys and theoretical studies as well. A number of amateur researches are considered innovative and they are highlighted below.

4.1 Air-controlled Camera Shutter [1a), (8)]

(by Joseph Liu in Hong Kong, 1972)

Figure 4.1

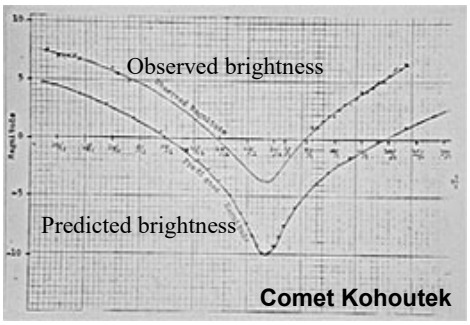


The shutter of SLR (single-lens reflex) camera is proven too vibrative for very high-resolution photographic works. At shutter speed of a fractional second to few seconds, it can ruin many promising planetary and lunar photographs. The right picture shows how Joseph Liu solves the vibration problem by means of a homemade leaf shutter mechanism. The leaf shutter is released by an air bulb. It works so gentle that Jupiter enlargement up to few inches diameter can be printed without image burr.

4.2 Project " Comet Kohoutek" [(8)]

(by joint schools, 1973-1974)

Figure 4.2



An observational project jointly run by 18 secondary schools in Hong Kong when the Comet Kohoutek (C/1973 E1) began visible in November 1973. The picture shows a plotting from their 20-page report about the comet's observed brightness against predicted brightness. The participating students were trained by the Hong Kong Amateur Astronomers' Union (now the Hong Kong Astronomical Society) on stellar magnitude assessment and systematic recording. Comet Kohoutek lay beyond Jupiter's orbit when discovered in March 1973 and was unusually bright for an object so distant. This led to over-estimates of the comet's likely magnitude close to perihelion on 28 December 1973. The comet was indeed less spectacular than originally anticipated, and the observation ceased by end January 1974.

4.3 Electronic Clock Drive Controller [8]

(by Alan Chu, 1975)

Figure 4.3

In the early Seventies, electrical motors for telescope clock drives run on alternating voltage of 200 volts. The alternating frequency (50 Hertz) controlled the tracking stability of the telescopes. This transistorized controller, designed to use alternating voltage or car battery, has 4 preset speeds for sidereal, lunar, solar and user-defined tracking. The hand box has fine controls to compensate any deviated speed so that a tracking accuracy better than 0.05% can be maintained in short-term. This is an advantage over the 50 Hertz method. The controller lasted until it was phased out by the newer quartz electronics.

4.4 Detection of Radio Signals from Cygnus A [8]

(by Alan Chu, 1976)

Figure 4.4

In Hong Kong, radio astronomy is restricted to literature studies most of the time. An experiment, however, was attempted in 1976 as shown in the picture. The configuration consists of primitive equipment: a Yagi VHF antenna of limited tilt-angles, a modified but high-sensitive tuner and a monitor meter to indicate the received signal strength. When Cygnus A, the expected strong radio source, passes above the antenna, the monitor meter does show a progressive increase of signal strength. The resolving power of the antenna is very poor, so it cannot distinguish the exact position of Cygnus A in the sky. Today, the radio emission from Cygnus A is believed due to the merger of smaller galaxies.

4.5 Automation of the HKSM Planetarium [8]

(by HKSM, 1980)

Figure 4.5

Carl Zeiss Star Projector Model 6

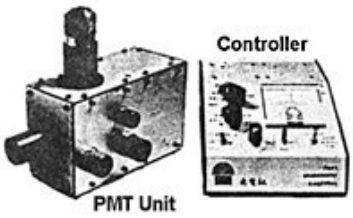
The Hong Kong Space Museum (HKSM) uses the Carl Zeiss Star Projector Model 6. Optically it is a top quality system but Carl Zeiss failed to commit the system's automation. A dedicated team, comprising engineers from the HKSM, the Cable & Wireless (Hong Kong) Ltd. and an American software house, tackled the problem in lieu of Carl Zeiss. The problem was solved in October 1980. Since then the star projector synchronizes smoothly with the its control platform, lighting and sound effect peripherals.

4.6 A Photometer System [3a]

(by the HKAS Photoelectric Section, 1983~87)

The photometer system, shown in the picture, has a light sensitive PMT (photomultiplier tube) and a controller to read and interpret the PMT currents to stellar magnitudes. The complete system is calibrated by UBV (Ultraviolet-Blue-Visual) standard filters. It took 4 years to complete the system because of frequent modifications of hardware and calibration procedures. Though not used often, the system design technique was mastered.

Figure 4.6

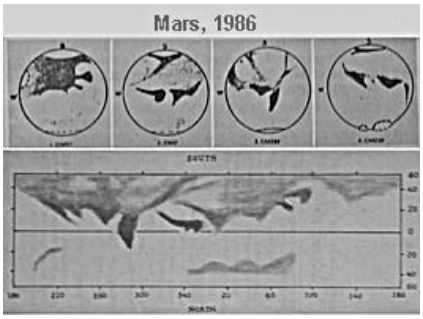


4.7 Mars Opposition in 1986 [3a]

(by the HKAS Planet Section, 1986)

Mars was observed from June to August when its diameter increased to about 23 arcsec in the 1986 opposition. Although the planet was observed with small telescopes of 76 to 200 mm (3 to 8 inches) aperture, it was possible to deduce a fairly detail Mars map from 39 drawings submitted by C K Yan, K M Leung, H C Ng, C L Chan and C W Chan. See the picture.

Figure 4.7



4.8 Video Recording System [3a]

(by the HKAS Occultation Section, 1986~1987)

The picture shows a video recording system in demonstration. It consists of a home-ground 14" f/4 prime mirror with a TV camera at the prime focus. The combination records stars up to 8th magnitude, quite sensitive by the technology of that time. Similar video recording systems were built to record six occultation events in 1986~87, the mercury transit across the solar disk on 13 November 1986, and the partial solar eclipse on 23 September 1987.

Figure 4.8

4.9 Global Earthquake Time Sequence and Bi Bian-Bao Model [3b]

(by Young Wai-kwok, 1989)

In 1989, an amateur proposed a hypothesis on the relationship between earthquakes and solar activities, after years of study. His findings were consolidated in the hypothetical *Bi Bian-Bao* (3B) model, which states that after an earthquake appeared in the west, another earthquake will

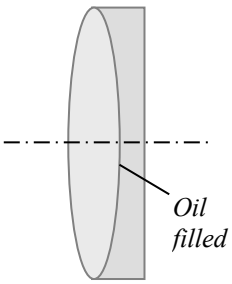
occur in the east with the moving speed of 10.6^0 per hour along the geographic longitude. About 75 % of global earthquakes with seismic magnitude greater than 5.5 obey this regulation. The model is supported by an assumption on the electromagnetic field generated by the massive media that flow under the mantle. Solar activities, such as the sunspots and solar winds, can interact with this electromagnetic field and hence affect the time sequence of global earthquakes. The 3B model does explain some earthquake occurrences in the 80's. The term *Bian-Bao* is a Chinese language meaning a string of firecrackers. *Bi Bian-Bao* refers to the analogue of two earthquakes occurring in sequence, like the burning sequence of a string of Chinese firecrackers.

4.10 Objective Lens Making [3b]

(by Chan Yuk-lun, 1990)

Lens making is extremely challenging and hence not common in Hong Kong. An amateur, however, did attempt to grind his 4" f/10 objective, and his result was quite rewarding. The objective, shown in the picture, is a flat-bottom doublet made up by one double-convex element of BK-7 glass and one plano-concave element of F-2 glass. The design is simplest because it only has three spherical surfaces, two of them are actually identical. The gap between both elements is filled up by oil to offset any irregularity of the contacting surfaces. The curvatures and centre alignment are controlled to ± 0.002mm tolerance. The lens corrects chromatic aberration but not spherical aberration and coma due to its simple design.

Figure 4.9

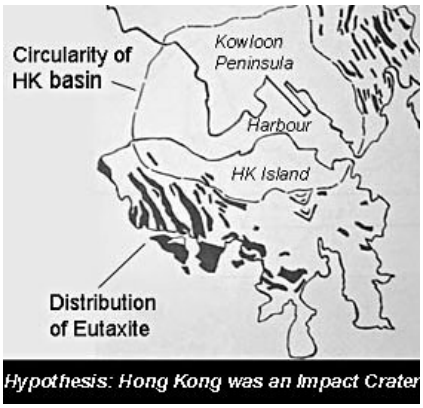


4.11 Hong Kong was an Impact Crater [3c]

(by Chan Chu-lok, Wu Siben and Luo Xiuquan, 1992)

In August 1992, a local amateur and two mainland professors presented the paper "Hong Kong was an Impact Crater" in the International Conference on Large Meteorite Impacts and Planetary Evolution, held in Canada. The paper hypothesizes that Hong Kong was a basin originated from large meteorite impact. It also discusses some geomorphologic evidences such as the circularity of mountains around the Hong Kong basin, the inner slope of the mountains being greater than the outer slope, and the distribution of Eutaxite inside the basin. (Eutaxile is a rock featured from sudden melting). The hypothesis, however, remains debatable because of coexisting geomorphologic features that oppose this hypothesis.

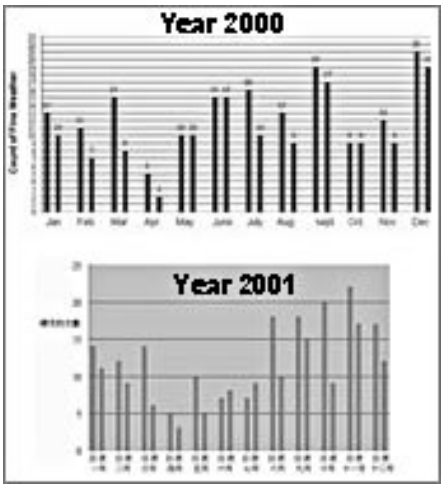
Figure 4.10



4.12 Weather and Stargazing [2]

(by Lau Kai-nan, 2000~2001)

Figure 4.11



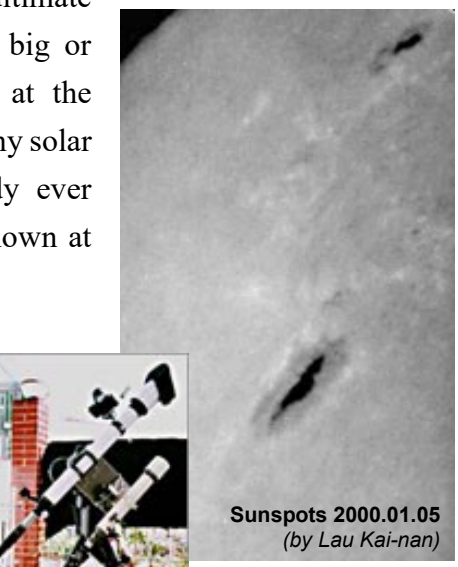
A local astrophotographer assessed the sky daily and compiled the attached graph showing the number of "fine" days and nights per month in the Year 2000 and 2001. The definition of "fine" was based on the distribution of clouds over his house. The graph shows that Hong Kong has roughly 120 "fine" nights per year which are supposed favorable for stargazing or astrophotography. The least favorable month for sky observation is April.

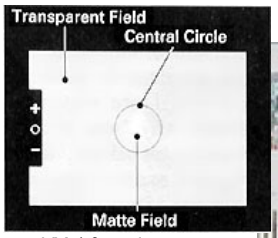
4.13 Challenging Equipment Limits [2]

(by Lau Kai-nan, 2000)

Figure 4.12

An aggressive local amateur always challenges the ultimate capability of his equipment, regardless the equipment are big or small. In 2000, he experimented to image the sunspots at the incredible of f/494, with a 3" (76mm) refractor and without any solar filter! The f/494 is an extremely high focal ratio nobody ever attempted before. His equipment and sunspot picture are shown at the right.





VX-1 focusing screen

Photographic Data
Telescope: Astro 3" f/12 refractor
Solar filter: not used
SLR Camera body: Vixen VX-1
Film: Fuji Superia 100
Method: Eyepiece projection
with Astro Or-5mm
Effective focal length: 37470mm (f/494)
Shutter exposure: 1/2000 sec

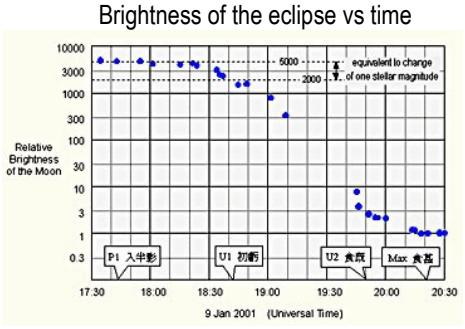
Imaging the sun without the protection of solar filter is unsafe to the observing eyes. The experiment at f/494 is not to encourage similar practice but to demonstrate that any equipment can be pushed to its optimal performance, if the user is willing to learn about it.

4.14 Total Lunar Eclipse in 2001 (8)

(by the HKAS Digital Imaging Section, 2001)

On 9-10 January 2001, a total lunar eclipse was successfully observed in Hong Kong. This observation utilized all digital capturing technique, the first attempt in the territory. Another co-existing phenomenon is the close proximity of *δ Gemini* from the Moon, noticeable in the eclipse sequence as shown in the picture. The complete eclipse course was recorded with a digital camera (Casio QV2300), and also broadcast real time with a modified webcam through the Internet. The raw frames from the digital camera and their inherent exposure data were analyzed by software afterwards. A full observation report of this eclipse is available.

Figure 4.13

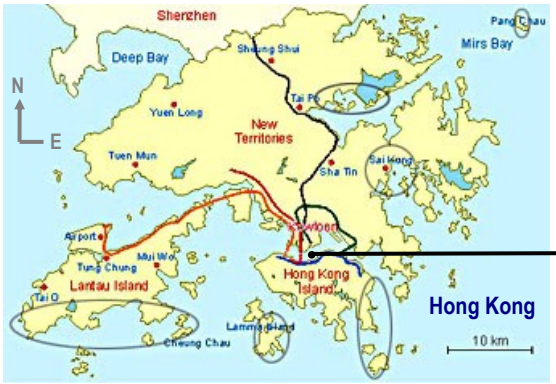


Click here for more pictures.

4.15 2001 Light Pollution Survey (1c), (8)

This is a large-scale survey of light pollution in Hong Kong, jointly conducted by the public astronomical organizations in the end of 2001. The survey employed photographic method to compare the brightness of the skies in various districts across the territory. The Victoria Harbour (see picture below) and its vicinity are so heavily light polluted that only lunar and planetary observations are feasible. Few places remain relatively dark where deep sky observations can still be made. These "darker" places are encircled in the Hong Kong map.

Figure 4.14 - The 2001 Light Pollution Survey in Hong Kong. The encircled areas are less affected by light pollution.

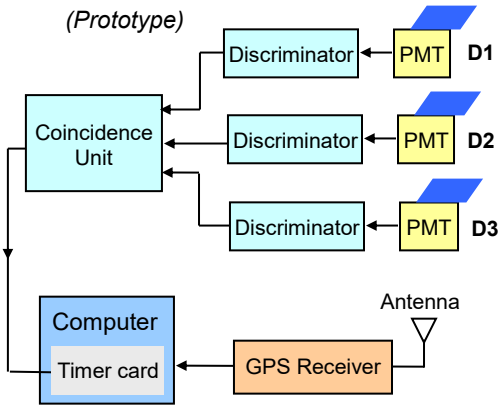


4.16 Project "Cosmic Ray Telescope" (7a)

(joint project, 2000 ~ 2006)

```This is a 6-year joint project of the Chinese University of Hong Kong and the secondary schools. The aim is to build a network of 36 cosmic ray detectors covering a large area in Hong Kong. The signals from these detectors are synchronized via the GPS (Global Positioning System), thus simulating a large-aperture cosmic ray telescope that can be used to monitor high energy cosmic rays. The telescope prototype, shown in the picture, was successfully tested. Each detector (D1, D2, D3) consists of a plastic scintillator, a wavelength shifter and a PMT (photomultiplier tube). When cosmic ray particles pass through the scintillator, it emits ultraviolet and bluish light, which is then changed to greenish light of longer wavelengths by the wavelength shifter. The greenish light is guided to the PMT for photon amplification. The discriminator transforms the noisy analog signals received from the PMT to logic (digital) signals before they are processed by the coincidence unit and analyzed by the computer. The project rolls off with satisfaction.

Figure 4.15 - Cosmic ray telescope




Cosmic ray telescope – testing detector part

## 4.17 The Theoretical Astronomy Group (TAG) 6(a)

The TAG is a study group established within the Hong Kong Astronomical Society in 1995. It is not a pure research group, but it does create an atmosphere to explore different topics on theoretical astronomy. The TAG members meet regularly to exchange ideas and publish articles on the Society's newsletters (see the attached picture). The topics explored by the TAG include, but are not limited to, astrophysics, cosmology, calendar algorithm, ephemeris computations, neutrino astronomy, books digest etc. Occasionally, a TAG issue turns to a debate over the Internet.

Figure 4.16

月球天秤動對月面物體形狀的影響

理論天文組通訊 (HKAS Newsletter 3/98)

鍾偉強

得悉本會名譽顧問周成虎教授過身的消息，深感悲痛。事緣周教授與本組的成立有莫大關係。早於一九八九年四至五月間，本會曾邀請周教授作長途三星期共六次的「天文物理」講座，反應熱烈。有見及此，本會隨即發出問卷查詢參加者對於成立一個天體物理小組的意見。基於正面的回應，遂正式開始一個小組，第一個討論的課題為宇宙論，故小組亦以此課題命名為「宇宙論組」，並邀得另一位名譽顧問—當時為理工學院應用物理系的高級講師洗定國博士為小組顧問，李北成為第一任組長，約一年多後，李北成遠赴美加深造天體物理，鍾偉強便接手為第二任組長至今。由於不想讓別人誤會以為本組只是討論宇宙論的題目，遂於一九九五年改名為「理論天文組」。
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Section 5. Equipment

Similar to many other places in the world, Hong Kong amateurs choose their own favour of astronomical equipment. This Section describes the popular equipment (hardware and software) available in Hong Kong since 1970. Some of them are no longer produced but become classics.

5.1 Telescopes and Cameras

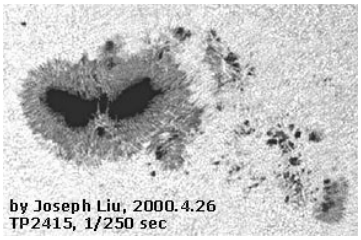
In the 1970's, the majority of local amateurs, apart from those who built their own reflectors, had limited choices of commercial telescopes. Astronomical telescopes from Europe and America were not common. The Japanese telescope makers: *Astro Optical, Unitron, Mazar* and *Vixen* were mostly known. The beginners used to start with one of the Japanese brands, choosing a 60mm f/15 refractor, a 76mm f/12 refractor, or a 100mm f/10 Newtonian on an equatorial mount without any polarscope nor motorized clock drive. A standard Japanese refractor came with a star diagonal, a 2X Barlow lens, three Huygenian eyepieces (H25, H12.5, H6), a moon glass, a sun glass and a white plate for solar image projection. The supplied eyepieces had narrow field-of-view (about 40^0) and short eye-relief. The sun glass was cracked easily by the accumulation of solar heat falling on it. Some brands provided a 4 cm hole on the telescope's front cap to stop down the aperture, thereby reducing incident solar rays to a safe level. Optional accessories, such as Orthoscopic eyepieces, Herschel solar wedge, motorized clock drive, camera adapter etc., were expensive. Not many amateurs could afford larger refractors like the *Unitron* 100mm f/15.

Figure 5.1 - A long refractor made in the 70's

In about 1973, a unique SLR (single lens reflex) camera emerged in the local astrophotography circle. It was the Olympus OM-1. This model was unique because it had a quiet shutter, a mirror lock, interchangeable focusing screens, a bright view finder and a body weight of only 0.5 kg --- many features that every photographer loved to try. Other rivaling cameras appeared later in the local market, including the Pentax MX, the Nikon FM and the least expensive Ricoh XR, but none of them were as versatile as the OM-1 except the Nikon FM. A few amateurs used the Topcon, Nikon-F, Miranda and Exaktar SLR cameras in favour of their wrist-level viewfinders. The black & white films were more common than colour in the old days of astrophotography because

Figure 5.2 OM-1 camera

Figure 5.3 - Sunspots



they could be developed and processed at home. The B&W Kodak Plus-X (ASA 125), Tri-X (ASA 400) and the high contrast copy film (ASA 64) were mostly used in the 70's. The B&W Kodak Tech Pan 2415 was chosen by Mr. Joseph Liu for his deep-sky (film hypered) and solar photos. "TP2415" was originated from solar photography, but its high contrast and fine grain emulsion makes it equally suitable for lunar and planetary works. (See Figure 2.10 & 5.3.)

While the Japanese small refractors continued to dominate the local market, the Celestron 8 SCT (8-inch Schmidt-Cassegrain Telescope), first launched in the United States in 1970, was not common in Hong Kong. The local impression of SCT was that the telescope optics was marginally qualified, its fork mount was awkward to use at the latitude of Hong Kong (22^0 N), and there was no immediate demand of compact scopes like the SCT. It took years until the late 80's that the Celestron 8 began to gain favour in the territory. However, the design of fork mount remains unsuitable for the low latitudes, and the Hong Kong users prefer to support the SCT on German-type equatorial mounts. Today, the SCT, coupled with CCD imaging devices, change the general impression significantly. The SCT, made by Celestron and Meade from 5" to 16" aperture, are growing in the local market, especially for the digital imaging application.

One the other hand, the "Tasco" optics gained its niche by means of advertisements and prices. Although the Tasco telescopes and binoculars were rejected by the demanding amateurs, many novices, especially the teenagers, in fact got their "first" telescopes from Tasco at prices hardly found in other brands. The Tasco often exaggerated in advertisement, yet admittedly it did contribute to the popularization of astronomy. It is ironic that certain local veterans were trained up by using Tasco telescopes, though they discarded the brand in later stage. The Tasco itself was not an optics manufacturer. Tasco telescopes, and similar competing models, were made by OEM (original equipped manufacturers) in Japan in the 80's, then in Taiwan, and now many of its products are made in Mainland China too. The present Celestron and Meade follow similar policy to have their cheap achromatic refractors and Newtonians made in China. But for the more discriminative observers in Hong Kong, they do not use the achromatic refractors which have residual colour aberration; they use APO (apochromatic) refractors for least aberration. A few folks love to use Maksutov-Cassegrain or Maksutov-Newtonian telescopes.

Figure 5.4

The right picture is a typical observing station of a local amateur astronomer who lives in urban area. It is located at the roof of a high-rise residential building. He uses a 235mm (9.25") SCT on a computerized equatorial mount. Today it is rather "unusual" to own a private backyard observatory. The roof is likely the most common choice. When a roof or even a balcony is not available, a rural site for shared use becomes an alternative. The "Taipo" site, rented by 10 users since August 2000, is one example.

Below is a glimpse of the equipment used by the majority in Hong Kong today: [8]

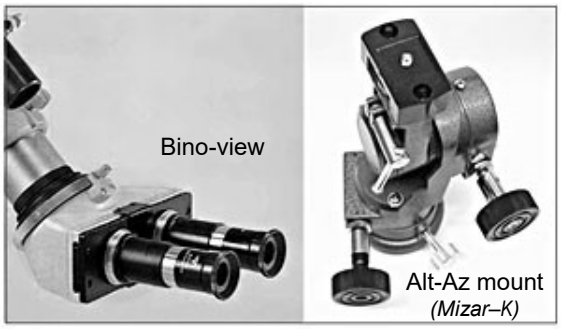
- **Celestron** Achromatic refractors: 8cm (3.1") f/5, 8cm f/11
  Schmidt-Cassegrain: (5", 8", 9.25", 11" & 14" aperture)
- **Meade** Schmidt-Cassegrain: (8", 10", 12" & 16" aperture)
  Maksutov-Cassegrain: ETX90 (3.5" f/13.8)
- **Vixen** APO refractors: ED102SS (4" f/6.5)
  Cassegrain: VC200L (8" f/9)
  Newtonian: R200SS (8" f/4)
- **Takahashi** APO refractors: FC60, Sky90, FS-series
  Cassegrain-Newtonian: CN212 (8.3" f/12 and f4)
- **Astro-Physics** APO refractors: Star12ED (4.7"), EDT13 (5.1")
- **Intes** Maksutov-Cassegrain: MK67 (6" f/12 or f/10)
  Maksutov-Newtonian: MN56 (5" f/6)
- **TEC** Maksutov-Cassegrain: 8" f/20, 10" f/20

Figure 5.5

Equipment in Taipo observing site, 2000.10.8

- Binoculars: 8x42, 7x50, 10x50, 10x60, 20x80, Bino-view
- Equatorial Mounts: Mizar AR
  Vixen GP series, New Atlux
  Takahashi EM series, NJP, TGSP
  Losmandy GM-8, G-11
  Gemini G40
  Astro-Physics GTO900
- Altitude-Azimuth Mount: Mizar-K
- Solar filters: Baader, Thousand Oaks (white light)
  Daystar, Coronado (hydrogen-alpha)
- Eyepieces: various types from the ultra-wide angle (82^0)
  to the planetary Orthoscopic (2.8mm)

Figure 5.6 - Two accessory favorites

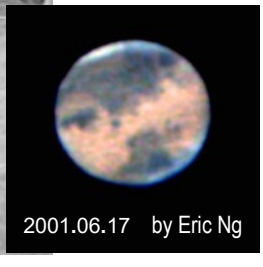


Two telescopes of extreme sizes, homemade in the late 90's, are noticeably interesting: the 16" f/4.5 Dobsonian telescope and the very compact 2" solarscope. Both are illustrated in Figure 5.7. The Dobsonian, though not the largest ever built, is probably the lightest among the 16-inch class. It weights about 30 kg, making it truly transportable to the star parties. The prime mirror is just the right size to avoid the need of an ancillary staircase when it points to zenith. The Dobsonian mirror is powerful, as indicated by the Mars inset (Figure 5.7b) which was taken

Figure 5.7

(a) The home-built 16" f/4.5 Dobsonian

(b) Mars from the 16" Dobsonian



(c) The compact solarscope and its solar image

with a digital camera over the eyepiece but without any need of motor tracking at all. The solarscope (Figure 5.7c) consists of a 7 x 50 (2" diameter) finder scope, a solar filter on the objective, and a digital camera behind the eyepiece. The whole combination produces a solar disk image of about 400 pixels, which is large enough to resolve any sunspot as small as 0.5% of the solar diameter. The solarscope serves as a handy patrol telescope before heavier (more powerful) equipment become necessary.

Figure 5.8

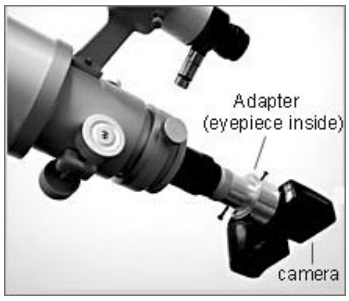
A few solar prominence observers are equipped with hydrogen-alpha (H-α) filters from Daystar and Coronado. They posted prominence images occasionally in the HKAS Discussion Group. (2)

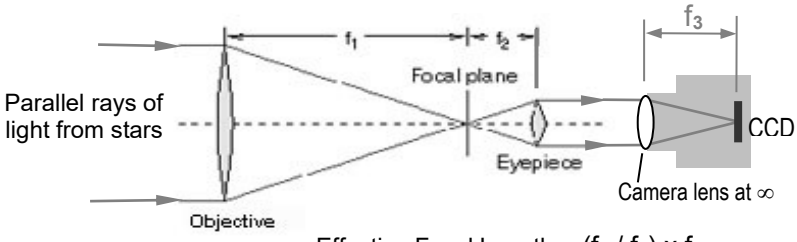
5.2 Digital Imaging Devices

Since Year 2000, two digital cameras have been used extensively for astro imaging. They are the Nikon Coolpix 950 (later versions CP990, CP995) and the Casio QV2300 (later version QV2800). Each model has a unique 'swing" lens head so that the camera can be coupled to the telescope at convenient view angles. Figure 5.10 shows how the coupling is done and it is called an *afocal system*. The effective focal length of an afocal system is given by the formula
"EFL = telescope magnification x focal length of the camera lens". By changing the telescope magnification through different eyepieces or the zoom range of the digital camera, the effective focal length (and hence image size) can be adjusted. This proves the afocal system highly effective for lunar and planetary imaging where long exposure time is not necessary. The afocal system is now widely recognized as the digital imaging basics. Its application is extended to the shooting of sunspots and brighter Messier objects as well. One team of Hong Kong amateurs had their afocal images featured in the cover of the Sky & Telescope magazine, August 2001.(1b) Figure 5.11 is a batch sample of the afocal images.

Figure 5.9 - Digital cameras

Figure 5.10 - Afocal system





Effective Focal Length = $(f_1 / f_2) \times f_3$

Figure 5.11 - Images from afocal system [8]

(Taken through Takahashi FS102 Refractor, Celestron C14 and C8 Schmidt-Cassegrain with Nikon CP950 or Casio QV2300 digital camera. All images are scaledown of the originals.)

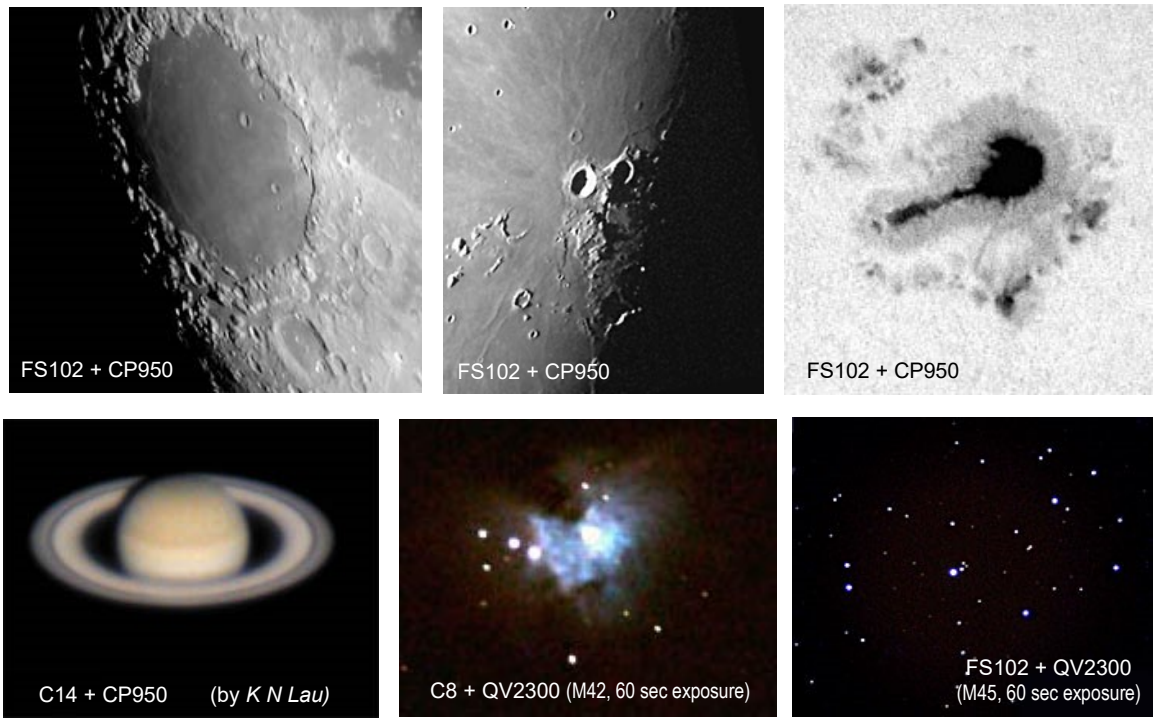
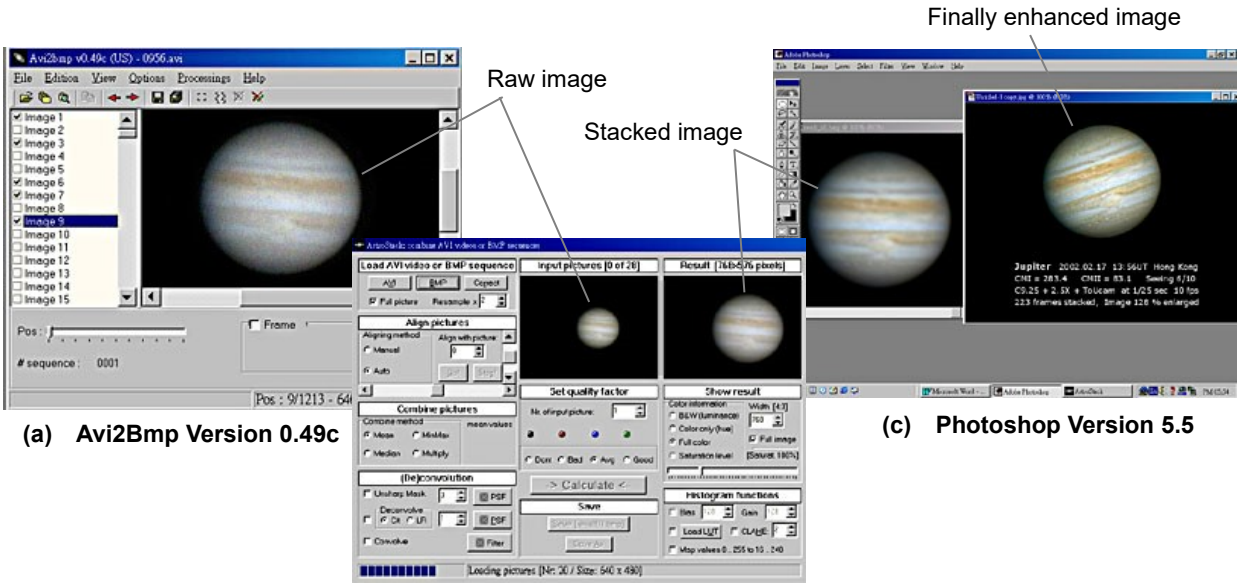


Figure 5.12 - ToUcam

The technique of digital imaging continued to evolve after the afocal system. In late 2001, a Philips webcam called *ToUcam* was available for experiment. It has a CCD array of 640 x 480 pixels and is capable to shoot colour video at low light conditions. The experimenters were excited to test this little device on planets. First, the ToUcam's front lens was removed and replaced by an eyepiece adapter as shown in Figure 5.12. The modified webcam was then plugged to a 2.5X Barlow lens which was in turn plugged to the visual back of the Celestron C14 telescope, giving an effective focal ratio of f/27 in the whole configuration. When this ToUcam was activited by programs on the PC, Jupiter looked splendid in the computer monitor. The planet measured 350 pixels in diameter, big enough to show rich details not experienced in the previous afocal system. A 2-minute video on Jupiter at 1/25 second shutter speed was taken. The best frames from the video were then extracted, stacked to suppress the frame noises and finally enhanced by digital processing software (see Figure 5.13). The Jupiter image so produced was surprisingly successful. Encouraged by this result, the ToUcam has become a popular tool to image Jupiter in Hong Kong. Figure 5.14 shows two typical Jupiter images from the ToUcam. The image resolution is so good that it is indeed possible to study the atmoshperic changes in Jupiter (denoted by the oval BA and GRS in the picture).

Figure 5.13 - Commonly used digital processing software

(a) Avi2Bmp Version 0.49c : To extract raw frames from a video clip
(b) Astrostack Version 0.9 : To stack and align raw frames extracted by (a)
(c) Photoshop Version 5.5 : To enhance a raw or stacked frame



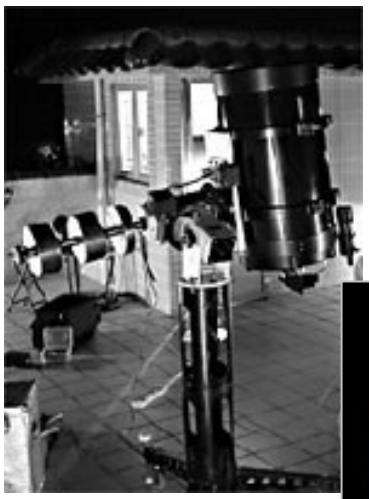
(a) Avi2Bmp Version 0.49c

(b) Astrostack Version 0.9

(c) Photoshop Version 5.5

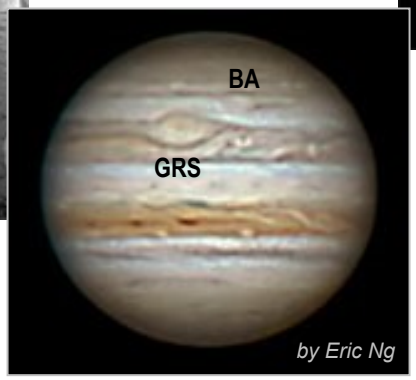
Avi2Bmp (*http://avi2bmp.free.fr/telechar.htm*) and **Astrostack** (*http://utopia.ision.nl/users/rjstek/english/software/*) are freeware downloadable from the Internet.

Figure 5.14 - Jupiter images from ToUcam through Celestron Schmidt-Cassegrain telescopes

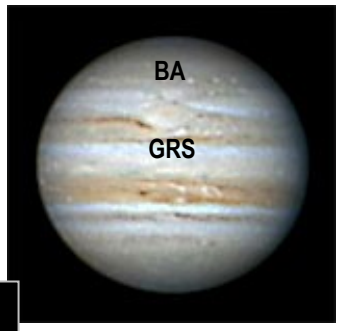


(a) Celestron C14 Schmidt-Cassegrain on Gemini G40 mount

(b) 2.5X Barlow lens



(c) Jupiter 2001.12.31 captured with Celestron C14 + 2.5X Barlow lens + ToUcam



(d) Jupiter 2002.02.17 captured with Celestron C9.25 + 2.5X Barlow lens + ToUcam

(**GRS** = Great Red Spot)

The merit of ToUcam is believed in its 1/25 second shutter speed, which is fast enough to freeze the jitering of images due to air turbulences. By discarding the burr frames of the video and stacking only the sharper frames, it is possible to produce a quality Jupiter image that challenges the more expensive cooled CCD systems. The ToUcam performs equally well on the Moon but not on deep sky objects that demand minutes of exposure not accessible from the camera. However, few experimenters are trying to modify the ToUcam for long time exposure, or even cool its CCD chip with some means for reduced image noises.

Prior to the use of ToUcam, an alternative method was in fact developed by a local amateur. He used a monochrome CCTV camera body to shoot Jupiter through his telescope, then recorded the video in digital tapes.[7e] The result was comparable to the ToUcam but only mononchrome images were obtained. Colour images had to be created by RGB composition (Figure 5.17). The CCTV camera and the digital video recorder were expensive too, making his method not as common as the ToUcam. On the other hand, a few amateurs did try to shoot deep-sky objects with genuine cooled CCD systems made by Santa Barbara Instrument Group of the United States (e.g. ST-237, STV, ST-7 / ST-8 series) and by Starlight Xpress of the United Kingdoms (e.g. SXL8, HX516, MX916)[7f], but their productivity was low due to the difficulty of acquiring dark sites. Much of the CCD applications are biased to solar, lunar and planetary imaging. Local deep-sky lovers normally take astrophotographs overseas using films rather than CCD.[3c]

Figure 5.15

Figure 5.16

Digital equipment for astrometry are not common yet, though few amateurs are interested to explore asteroid astrometry using CCD and software processing technique.

Figure 5.17 - A RGB Jupiter image posted in the HKAS newsletters.

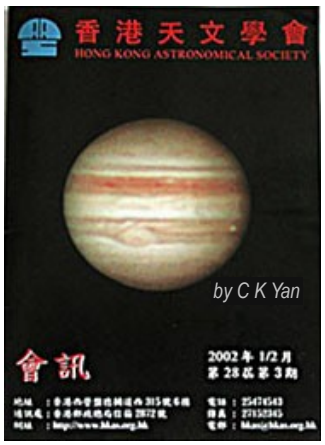


Figure 5.18 - CCD workshop class for the HKAS members

5.3 Astronomy Software

Computerized star maps were not experienced until the late 1980's. The first known in Hong Kong was *EZCosmos*, developed by Future Trends Software Inc. of the United States in 1990. This software works on DOS-based computer as old as IBM PC/AT (4.7 MHz processor speed), and is still used today for its simplicity. Figure 5.19a illustrates an EZCosmos's sky map plotted for Hong Kong just before sunset, 15 May 2002. Notice that the 5 naked-eye planets, the Moon and the Sun are all aligned in the western sky, a rare event that repeats only in hundreds of years. Other DOS-based astro software are also found in the Internet, e.g. the Sky & Telescope's webpage that collects *BASIC* programs written since 1984 [1d]. Today, software for popular astronomy are interactive. Figure 5.19b shows a Microsoft Windows-based program *Starry Night Pro* developed by Sienna Software in 1999. It is often used to demonstrate the constellations in star parties. *TheSky* from Software Bisque is a similar but more powerful program. It is used to search celestial objects, to preview sky events and to control telescopes by the individuals. *TheSky* also has a "pocket edition" for palm-size computers (Figure 5.20). Miscellaneous freeware for planetary and lunar studies are downloadable from the Internet, e.g.

JupSat 95 http://indigo.ie/~gnugent/JupSat95/
Mars Previewer II http://skyandtelescope.com/resources/software/article_328_1.asp
Meridian http://www.geocities.com/octp_quebec/meridian/english.html

Figure 5.19 - Astronomy software

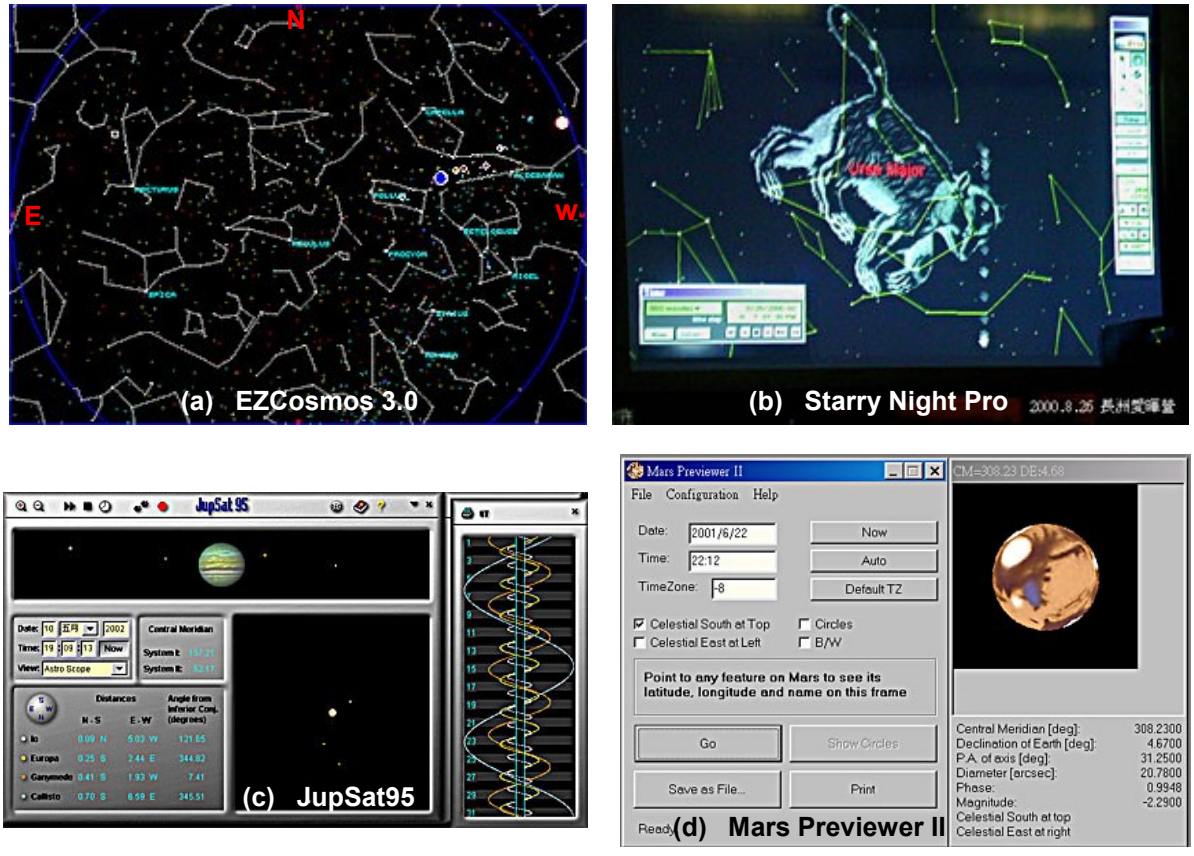
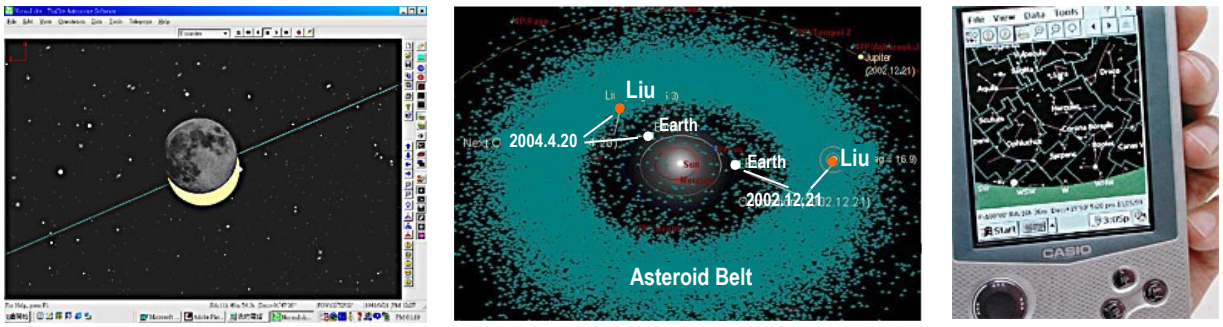


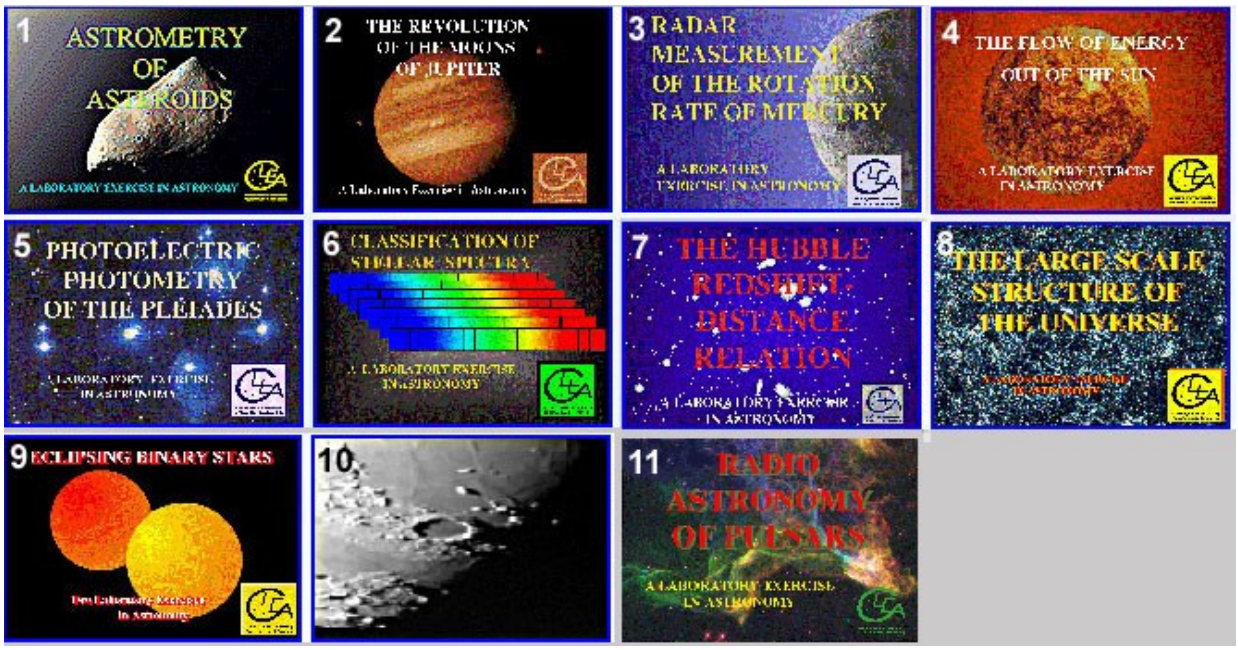
Figure - 5.20 “TheSky” astronomy software

Left : To simulate the solar eclipse on 21 Sept 1941 in Hong Kong (eclipse maximum at 12:27 pm).
Middle : To simulate Asteroid Liu’s orbital position & brightness (16th mag) during opposition in April 2004.
Right : “TheSky Pocket” edition for palm-size computers.



Astronomy software do a lot more than sky simulation. Some software are designed to simulate laboratory exercises using observatory-grade equipment. The “CLEA” (Contemporary Laboratory Exercises in Astronomy) from Gettysburg College of the United States (*http://www.gettysburg.edu/academics/physics/clea/CLEAsoft.overview.html*) is a typical source available worldwide. The CLEA contains over 10 software exercises, see Figure 5.21. A few local amateurs are using it in self-learning.

Figure 5.21 - CLEA (Contemporary Laboratory Exercises In Astronomy)



1. Astrometry of Asteroids 2. The Revolution of the Moons of Jupiter 3. Radar Measurement of the Rotation Rate of Mercury
4. The Flow of Energy Out of the Sun 5. Photoelectric Photometry of the Pleiades 6. Classification of Stellar Spectra
7. The Hubble Redshift-Distance Relation 8. The Large Scale Structure of the Universe 9. Eclipsing Binary Stars
10. The Height of Lunar Mountains 11. Radio Astronomy of Pulsars

Section 6. Outlook

This paper has briefed the 60-year history of amateur astronomy in Hong Kong. It began with very few stargazers but now accretes to over 1,000 members in various astronomical organizations. In spite of amateurs, some members are very active observers, astrophotographic masters or even have university degrees in astronomy. This can be witnessed from the astronomy discussion group in the Internet (HKAS *e*Group), which has accumulated 10,000 messages in a short time of about two years.(2) Doubtlessly the Hong Kong amateurs will continue their development. Some areas have been identified where progress is on the way:

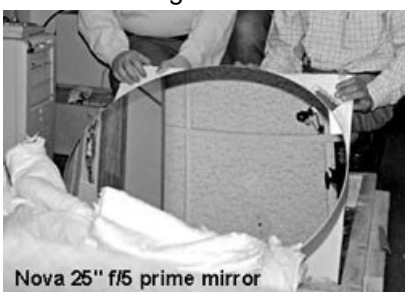
6.1 The 2001 Survey of Light Pollution in Hong Kong indicates that the number of dark sites qualified for deep-sky observation is diminishing. The public astronomical societies will submit the survey report to the Environmental Protection Department, seeking for an interim solution, if not long-term. The negotiation with government officials is not easy, but something can be done at least before light pollution is even worse.

6.2 The fast development of digital imaging technology has revolutionized the way we search and record celestial objects. The traditional film stills has its merit in wide-field deep-sky photography but such application is hindered in Hong Kong due to limited dark sites. CCD imaging devices will continue to spread and replace film as the principal tool of astro imaging in the territory. The demand of training courses on digital imaging will increase, and a lot of promotion of astronomy can be done through such training courses.

6.3 Being geographically favorable for planetary observations and in view of the local observations biased to this field, Hong Kong is in good potential to be the Southeast Asia coordinator for the collection and distribution of planetary information. The Internet discussion group has proven its effectiveness to exchange astronomical information between the local stargazers and their foreign counterparts. An increase of subscribers and visitors to this discussion group is anticipated.

6.4 By the time of this writing, it is known that a top quality 25-inch (63cm) f/5 mirror for telescope making arrived Hong Kong, that a spectrograph was coupled to the 0.5m telescope in the Ho Koon observatory, and that the project “Cosmic Ray Telescope” (Section 4) runs on schedule. A solar tower is also under planning. It is hoped that the addition of new equipment, together with the struggle against light pollution, may lead to another era of astronomical development in Hong Kong.

Figure 6.1



Nova 25" f/5 prime mirror

References

(1) The Sky & Telescope magazine
   a. April 1974 (A Hong Kong Observatory, page 221)
   b. August 2001 (Astro Imaging with Digital Cameras, page 128)
   c. October 2001 (The Stars Through the Eyes of the Dragon, page 76)
   d. Resource webpage *http://skyandtelescope.com/resources/*

(2) The HKAS Discussion Group (eGroup) *http://groups.yahoo.com/group/hkas/*

(3) Astronomical Researches in Hong Kong (Proceedings of the Hong Kong Astronomical Convention)
   a. Volume I, 1989
   b. Volume II, 1992
   c. Volume III, 1994
   d. Volume IV, 1997

(4) The Research Resources webpage of the Hong Kong Space Museum
http://www.lcsd.gov.hk/CE/Museum/Space/Research/e_index.htm

(5) The webpage of Joseph Liu *http://liu.hkas.org.hk*

(6) The webpages of local astronomical organizations:
   a. Hong Kong Astronomical Society 香港天文學會 *http://www.hkas.org.hk/*
   b. Sky Observers' Association 坐井會 *http://www.skyobserver.org/*
   c. Space Observers Hong Kong 觀天會 *http://www.sohk.org.hk/*
   d. Astronomy Workshop 天文工作坊 *http://www.astronomyworkshop.com*
   e. Hong Kong Space Museum 香港太空館 *http://www.lcsd.gov.hk/hkspm/index.html*.
   f. Ho Koon Nature Education & Astronomical Centre 可觀中心 *http://www.hokoon.edu.hk/*

(7) Other Hong Kong astronomy related webpages:
   a. Astroworld *http://www.phy.cuhk.edu.hk/astroworld/*
   b. Astronomy Club of the University of Hong Kong *http://www.hku.hk/suastro/*
   c. Making Astronomical Telescope *http://smart.bch.cuhk.edu.hk/lwong/telescope.htm*
   d. Leonids 1998 *http://science.nasa.gov/newhome/headlines/ast27nov98_1.htm*
   e. Yan Chi-keung's webpage *http://hk.geocities.com/yanchikeung/index.html*
   f. Edward Tam's webpage *http://www.geocities.com/kf_tam/*

(8) The astronomical archives of Alan Chu

Glossary

AAS	Hong Kong Amateur Astronomical Society
APO	Apochromatic (refractor)
CCD	Charge-coupled Device
CCTV	Closed Circuit Television
GPS	Global Positioning System
GRS	Great Red Spot
HKAS	Hong Kong Astronomical Society
HKSM	Hong Kong Space Museum
IAU	International Astronomical Union
IOTA	International Occultation and Timing Association
NASA	National Aeronautics and Space Administration
PMT	Photomultiplier Tube
RGB	Red-Green-Blue (colour)
SCT	Schmidt-Cassegrain Telescope
SLR	Single-lens Reflex (camera)
SOA	Sky Observers' Association
UBV	Ultraviolet-Blue-Visual (filter)
UT	Universal Time

Acknowledgements

The author of this paper would like to thank Mr. Joseph Liu who provided the images in Figure 1.2, 3.4, 4.1, 5.3 and most of the materials in Section 2; members of the HKAS who provided their astro images in Figure 3.27, 3.29, 4.12, 5.7, 5.11, 5.14 and 5.17.

Original Pictures in CD-ROM

Appendix

All pictures in this document are compressed and shrunk.
The larger original pictures of Figure 1.1 to 6.1 are saved in CDROM.

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1 From the Internet 2 From Joseph Liu 3 Alan Chu's archives 4 HKAS's archives / HKAS *e*Group
5 Provided by HKAS members 6 Duplicated from HKAS / HKSM publications using digital camera

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