Session:	**[B2B-2] S7 : Historical Astronomy, Astronomy Education and Public Outreach**
Date:	August 19, 2014 (Tuesday)
Time:	14:00~15:30
Room:	Room B (Room 103)
Chair:	Young Woon Kang (Sejong University)

[B2B-2-1] **14:00~14:20**

[Invited] The Zero-point of the Zodiac of the Hindu Astronomers in Ancient India

Amalendu Bandyopadhyay (M. P. Birla Institute of Fundamental Research, M. P. Birla Planetarium, India)

In modern astronomy the vernal equinoctial (VE) point is taken as the starting point for measuring celestial longitudes. Due to the precession of equinoxes, the above point is receding back along the ecliptic. As a result, the longitudes of fixed stars are increasing every year. In ancient India, the Hindu astronomers did not favour the idea of fixed stars changing their longitudes. In order to stabilize the zodiac, they had taken as the origin a point which is fixed on the ecliptic and as such is quite different from the VE point. This initial point being a fixed one, the longitude of stars measured from this origin remain invariable for all time. The distance between this fixed initial point and the VE point is called ayanamsa in Hindu astronomy and the zodiac starting from this fixed origin, is known as fixed zodiac. The longitude of a heavenly body measured from this fixed point is known as sidereal longitude in Hindu astronomy. There was an epoch in the past when this initial point coincided with the VE point and the sidereal zodiac coincided with the tropical one. At that time, the value of ayanamsa was zero and thus the epoch may be called the zero-year. There is controversy over the determination of the zero-year. The reasons for the choice for the fixed zodiacal system by the Hindu astronomers as well as the epoch of zero-year have been found out on the basis of inferences available in various astronomical treatises of ancient India in Sanskrit.

[B2B-2-2] **14:20~14:40**

[Invited] Jesuit Astronomer Royal in China and 3,083 Stars in the Star-Catalogue Yixiangkaocheng

Sang-Hyeon Ahn (Korea Astronomy and Space Science Institute, Korea)

The stars in the Chinese star catalogue, Yixiangkaocheng, which were edited by the Jesuit astronomer Kögler in AD 1744 and published in AD 1756, are identified with their counterparts in the Hipparcos catalogue. The equinox of the catalogue is confirmed to be J1744.0. By considering the precession of equinox, proper motions and nutation, the star closest to the location of each star in Yixiangkaocheng, having a proper magnitude, is selected as the corresponding identified star. I identified 2848 stars and 13 nebulosities out of 3083 objects in Yixiangkaocheng, and so the identification rate reached 92.80 per cent. I find that the magnitude classification system in Yixiangkaocheng agrees with the modern magnitude system. The catalogue includes dim stars, whose visual magnitudes are larger than 7, but most of these stars have Flamsteed designations. I find that the stars whose declination is lower than -30° have relatively larger offsets and different systematic behaviour from other stars. This indicates that there might be two different sources of stars in Yixiangkaocheng. In particular, I find that μ1 Sco and γ1 Sgr approximately mark the boundary between two different source catalogues. The observer's location, as estimated from these facts, agrees with the latitude of Greenwich where Flamsteed made his observations. The positional offsets between the Yixiangkaocheng stars and the Hipparcos stars are 0.6 arcmin, which implies that the source catalogue of stars with $\delta > -30°$ must have come from telescopic observations. Nebulosities in Yixiangkaocheng are identified with a few double stars, o Cet (the variable star, Mira), the Andromeda galaxy, ω Cen and NGC6231. These entities are associated with listings in Halley's Catalogue of the Southern Stars of AD 1679 as well as Flamsteed's catalogue of AD 1690.

[B2B-2-3] **14:40~15:00**

[Invited] Historical Astronomy in National Astronomical Obervatory of Japan: Long-Term Variations of the Delay of the Earth Rotation

Kiyotaka Tanikawa (NationalAstrnomical Observatory of Japan, Japan) and Mitsuru Soma

Historical astronomy is defined to be a branch of science in which modern problems are studied using the ancient astrnomical records (Stephenson 1997). Depending on the characters of the records, the corresponding branches differ. Thus, for example, long term variations of the number of meteors and meteor showers may give us information on the life-time of mother comets and on the scattering rate of dust particles along the orbits of the comets (Ahn 2003; Yang et al. 2005). Historical supenovae give us information of the physics of supernova events (Stepehnson & Green 2002). A systematic study of the variations of brightness in the sequence of catalogs of stars extending more than one thousand years may reveal long-period variables (Fujiwara et al., 2004). It is well known that Earth's rotation decelerates secularly. This is because the angular momentum of the Earth-Moon system conserves and the Moon increases its orbital angular momentum by receding from the Earth. The secular change of Earth's rotation rate is accumulated to the delay of the time measured by the Earth rotation relative to the uniformly flowing time. This delay is called Delta T. The historical solar and lunar eclipses and the occultations of planets and stars by the Moon are the unique data for the determination of Delta T. The smoothed curves of Delta T has been obtained by Stephenson (1997) from historical (timed) solar and lunar eclipses. There are two unsolved problems related to the variations of Delta T. One is the inconsistency between the expected and observational secular trends. The observed trend of Delta T is smaller than the expected trend from the angular momentum conservation. This may be explained by the long-term, of the order of ten thousand years, climate changes. The second problem is the smoothness of the Delta T variations. Our target is to show the existence of short-term (less than few hundred years) variations of Delta T. In our talk, selecting and using records of solar eclipses of high quality for several periods of time between BC 700 and AD 1400, we give strong evidence of short-term variations of Delta T. In the talk, the method of analysis will be described graphically.
Our result may provide an astronomical basis for the existence of the short-term climate variations.

[B2B-2-4] **15:00~15:15**

An Identification of the Animal Paintings in the Hall of Bulls of the Lascaux Cave as the Constellations

Kwang-Tae Kim (Chungnam National University, Korea) and Young-Sik Kim

Since the discovery of the Lascaux cave in France in 1940, several attempts for identifications of the animal figures as constellations have been made. Among these are the Pleiades and the Taurus the most successful and well known to public to date. Among a total of 36 animals drawn some 17,000 year ago in The Great Hall of the Bulls, the four bulls (or aurochs) and the Unicorn are the dominant figures. We report here that all of these main animal figures are identified as the well known constellations such as the Orion+Canis Major+Canis Minor+Gemini, the Leo+Virgo, the Libra+Scorpio+Sagittarius, and that the dark animals as dark molecular clouds which form in line so spectacular along the 4th galactic quadrant from the Galactic center toward Canopus and Sirius. In this paper, we present the astronomical identification processes we made and some implications of the findings are discussed in relation to the Homo sapiens identity of Cro-Magnons in the Paleolithic Age.

Poster Session **15:15~15:30**

Chairs: **Il-Sung Nha**

Young Woon Kang (Sejong University)