ANNOUNCEMENTS

- NO HOMEWORK DUE THIS WEEK.

- TWO MORE OBSERVING PROJECTS DUE THURSDAY DECEMBER 3rd, first Thursday following Fall Break.

- THERE WILL BE ONE MORE HOMEWORK FOR CREDIT TO BE HANDED OUT TUESDAY AFTER BREAK AND DUE THE FOLLOWING TUESDAY (so we can return it to you before the final exam).

- LAST OPTIONAL OBSERVING NIGHT OF YEAR AT SBO TONIGHT 7:00-8:30pm (IF CLEAR, OF COURSE)
Chinese astrology similar to Western astrology but incorporated into a general set of auguries using e.g. tortoise shells and animal bones which goes back to c. 16th Century BCE. Unique aspect: Chinese always recorded the outcome of the augury; i.e. was it correct? 12 Chinese years (e.g. 2014 is “year of the Horse”) keyed to Jupiter, the Year Star. Chinese astrologers also tracked 60 year cycles keyed to Jupiter/Saturn conjunctions which repeat in same zodiac sign every 60 years (12 signs + 5 elements = earth, air, fire, water and metal).
CHINESE ASTRONOMICAL RECORDS
EXCEPTIONALLY ANCIENT & ACCURATE

- OLDEST WRITTEN ECLIPSE RECORDS FROM c. 1200 BCE CARVED ON TORTOISE SHELLS AND ANIMAL BONES

- POSSIBLY NON-HISTORICAL STORY OF ASTRONOMER BROTHERS He AND Xi WHO WERE BEHEADED FOR GETTING DRUNK AND FAILING TO PREDICT A SOLAR ECLIPSE c. 2000 BCE

- SIMILARLY ANCIENT RECORDS FOR UNUSUAL PLANETARY CONJUNCTIONS (c. 1900 BCE) AND FOR SUPERNOVAE (c. 1400 BCE is probably the earliest but not confirmed).

  RECORDS ON “ORACLE BONES”

- EARLIEST CONFIRMED SUPERNOVA RECORDED BY CHINESE IN 185 CE. EXCELLENT AGREEMENT WITH MODERN OBSERVATIONS SINCE THAT DATE.
KEEPING PACE WITH *TI’EN* (HEAVEN)

**SU SUNG’S WATER CLOCK**

Fig. 1. A pictorial reconstruction of the astronomical clock-tower built by Su Sung and collaborators at K’ai-fêng in Honan province, then the capital of the empire, in A.D. 1090. The clockwork, driven by a water-wheel, and fully enclosed within the tower, rotated an armillary sphere on the top platform and a celestial globe in the upper storey; puppet figures giving the time meanwhile of the passing hours and quarters by signals of sight and sound. (Original drawing by John Christiansen.)

**ARMILLARY SPHERE**

This handsome copper-bronze armillary sphere, shown here standing in the courtyard of the Beijing Observatory, is now installed at the Purple Mountain Observatory in Nanjing.

**“SKY MEASURING SCALE”**

The observatory at Gaosheng in northcentral China dates from the 13th century, and was built by the leading astronomer Guo Shoujing. A horizontal rod in the upper aperture casts a midday shadow on the long, low wall which extends northwards from the base of the building. The wall therefore is a sky-measuring scale, and enabled Guo Shoujing to establish an accurate measurement of the length of a year.
CHINESE CLOCKS WERE THE MOST ACCURATE IN WORLD UNTIL THE RENAISSANCE

DEVELOPED ENTIRELY SEPARATELY FROM WESTERN TECHNOLOGY…

WHY DID THIS DEVELOPMENT NOT CONTINUE ???

SU SUNG’S WATER CLOCK
PHILOSOPHY of HEAVENLY “PORTENTS”

- Emphasis on change in Ti’en, the heavens (and on the Earth).

- The Emperor is responsible for all things in the Empire... and Ti’en was seen as being in the Empire

- **All changes initially interpreted as bad.**

- Sudden appearances were problems for the Emperor
  1) Supernovae and Novae (“Guest Stars’)
  2) Dramatic Meteor Showers
  3) Comets (“Broom Stars”)
  4) Conjunctions of Planets (“Planets in combat”)

KEY ELEMENT:

**EMPEROR WAS RESPONSIBLE FOR ALL THINGS IN THE EMPIRE ON EARTH AND IN HEAVENS. “TIEN”**.

IF SOMETHING WAS AMISS IN THE HEAVENS THEN IT WAS THE FAULT OF THE EMPEROR AND IT WAS TIME FOR A REGIME CHANGE !!!

⇒ ASTRONOMERS WERE THE CHINESE VERSION OF THE FBI/CIA; SECRETED AWAY IN THE BOWELS OF THE PURPLE PALACE MAKING SURE ALL WAS OK IN THE HEAVENS
CHINESE HAD CONSTELLATIONS FOR ALL THE STARS LIKE THE GREEKS ....but

They did this so that they could tell if something changed!

Sky was arranged by Social Status in Chinese society..
So the Emperor is at the North Pole!
CLOSE PLANETARY CONJUNCTIONS

- Happen semi-regularly (every few years) involving two of the bright planets (e.g., Jupiter & Venus).
- Alignments of several bright planets are rarer...once per decade.
- These are predictable events with astrological interpretations, which differ between cultures. (e.g., conjunctions are favorable aspects for Maya & Europeans vs unfavorable aspects for the Chinese.)
- Planets are not at all close together in space.

CLOSEST PLANETARY CONJUNCTIONS IN THE LAST 5000 YEARS, BOTH INTERPRETED BY THE CHINESE

At top: 26 Feb 1953 BCE

At bottom: 28 May 1059 BCE: "The Mandate of Heaven"
“GUEST STARS”

1. **NOVAE**: Star brightens by a few hundred times going from invisibility to being a semi-bright star. Now known to be due to gas being pulled off one star and dumped onto a nearby star creating an explosion.

2. **SUPERNOVAE**: Dying star explodes, brightening by thousands of times
   - Some are bright enough to see in daytime. Bright at night for months then slowly fades.
   - There has not been one seen in our galaxy for ~ 400 years. ➔ **WE ARE OVERDUE!!!**

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**THE “CRAB NEBULA” IS THE REMNANT GASES FROM THE SUPERNOVA OF 1054 CE**

**CHINESE TEXT ABOVE DESCRIBES THE EXACT LOCATION AND TIME OF BRIGHTENING OF THIS SUPERNOVA**
THE HISTORICAL SUPERNOVAE

- AT MOST 8 IN RECORDED TIME (DETAILS IN THE NOTES)

- FIRST RECORDED SUPERNOVA MAY HAVE BEEN AS EARLY AS 1400 BCE BUT IS NOT CONFIRMED AT PRESENT.

- 185 CE & 393 CE. REPORTED IN ONLY ONE TEXT. COMETS? BUT 185 CE NOW CONFIRMED BY LOCATION WITH A MODERN "REMNANT"

- 1006 CE; VERY BRIGHT “… [brightness] is a little more than one-quarter of the [full] moon.” Recorded in China, Japan, Korea and Arabia but NOT IN EUROPE. Seen in the Southern Gate constellation (= Greek constellation of Lupus, below Scorpio)
THE HISTORICAL SUPERNOVAE
(continued)

- 5 JULY 1054 CE: BRIGHTER THAN VENUS. VISIBLE IN DAYTIME FOR 23 DAYS & AT NIGHT FOR 20 MONTHS. SOUTH OF ALDEBARAN IN EASTERN SKY AT DAWN. RECORDED IN CHINA, JAPAN, ARABIA AND BY ANCESTRAL PUEBLOS AND MIMBRES PEOPLES IN THE AMERICAN SOUTHWEST

- 1181 CE: BRIGHT AS THE BRIGHTEST STARS. VISIBLE FOR ~ ½ YEAR AT NIGHT. RECORDED IN CHINA & JAPAN.

- NOV 6th 1572 and OCT 9th 1604: Tycho’s and Kepler’s supernovae. Both visible at night for ~ 1 year. Best records now in Europe.

- JAN 9th 1987: supernova in the Large Cloud of Magellan (satellite to our own galaxy). Naked eye at night only but you had to know exactly where to look.
MIMBRES POTTER BOWL FROM SOUTHERN NEW MEXICO (1054 CE)
CONSPICUOUS IN ITS ABSENCE:
THE STAR OF BETHELHEM

- REAL OR FIGURATIVE? ONLY DESCRIBED IN ONE SOURCE: BOOK OF MATTHEW IN THE BIBLE

- PROBABLY NOT A COMET OR SUPERNOVA SINCE NONE WERE RECORDED IN CHINA, JAPAN, KOREA OR ARABIA AT THAT TIME

- PROBABLY A CLOSE CONJUNCTION OF PLANETS. THESE OCCUR EVERY FEW YEARS AT SEMI-RANDOM TIMES ...but EXTREMELY CLOSE CONJUNCTIONS ARE VERY RARE. EVERY FEW HUNDRED YEARS THERE IS A VERY CLOSE CONJUNCTION BETWEEN VENUS AND JUPITER, THE TWO BRIGHTEST PLANETS.
SUMMARY OF EVIDENCE

- HEROD DIED FOLLOWING A LUNAR ECLIPSE IN ISRAEL. THERE ARE TWO POSSIBILITIES:

  1/  13 MARCH 4 BCE ➔ JESUS BORN IN 7 – 6 BCE OR
  2/  9 JANUARY 1 BCE ➔ JESUS BORN IN 3—2 BCE

- POSSIBLE CONJUNCTION THAT COULD HAVE BEEN THE “STAR”

  1/  3 JUPITER/SATURN CONJUNCTIONS MAY 27- DEC 1ST 7 BCE
  2/  JUPITER/VENUS 17 JUNE 2 BCE

LAST ONE WOULD HAVE BEEN VERY SPECTACULAR AS IMAGES OF THESE TWO PLANETS WOULD HAVE MERGED TO THE NAKED EYE

ALSO NOTE: MAGI = ASTROLOGERS?
BRIGHTTEST TWO PLANETS IN SKY

CONJUNCTION INVOLVING THE MERGER OF THESE TWO IMAGES IS VERY RARE AND EXTREMELY BRIGHT

ASTROLOGICALLY IN THE BABYLONIAN TRADITION THIS CONJUNCTION IS THE MOST POSITIVE COMBINATION OF THE MALE AND FEMALE ENERGIES.

BEST, BUT NOT ONLY, CANDIDATE FOR “THE STAR”.

Astronomically: close enough to appear as one bright object

Astrologically: a positive combination of the highest masculine and feminine principles (Zeus and Aphrodite)

(Stellarium)