ASTR170 Study Notes

Week 1	• The positions of objects on CS - specifying right ascension (in time units) and declination (in angular measure). • Rotation of Earth's axis → day + night. – Sky appears to rotate westward around Earth – because E rotates eastward → day + night. • The orbit of the Earth about Sun → different constellations being visible at different times of year. • Sun appears to complete 1 circuit of the ecliptic over 1 yr. • Paths of the planets on the sky lie close to the ecliptic. • Angular distance – angles – degrees, arc min and arc sec.
The sky around you	• E's eastward rotation → sun, moon, planets + stars – westward. • Any location – ½ celestial sphere – above horizon. • Zenith – above head. • Nadir – under feet. • Celestial equator – ½ way between celestial poles.
Seasons	• The Earth's axis of rotation is tilted at approx 23.5° from the perpendicular to the plane of the Earth's orbit. – This + Earth's orbital motion around the sun → seasons. • Summer – hotter – sun spends longer in sky + shines more directly on ground. – Earth-Sun distance – almost constant – does not affect

	seasons. • The vernal equinox + autumnal equinox → celestial equator intersects ecliptic. • When Sun is at equinoxes – length of day + night = everywhere on Earth. • When the sun is at the summer or winter solstice – day + night have big difference in day length. • Vernal Equinox: Sun crosses celestial equator – northward. • Summer solstice: Sun farthest nth pt • Autumnal equinox: Crosses celestial equator – southward. • Winter equinox: Most southern pt. • NOT caused when Sun is close or farther from Sun. • Earth's orbit – elliptical.
Moon	
Eclipses	• Full moon passes through Earth's shadow → sunlight cut off + the Moon darkens in a lunar eclipse. • Moon fully enters the dark umbra of the Earth's shadow → total lunar eclipse. • Enters penumbra (not umbra) → penumbral lunar eclipse. • Totality: Eclipsed moon = copper red because sunlight refracts through Earth's atmosphere + lights up the m's surface. • Solar eclipse: New moon passes exactly between the Sun and Earth, blocking out the Sun's light. – M's shadow sweeps over Earth's surface along path of

	totality. – Observers inside the path of totality see total solar eclipse. – Those just outside the path of totality but inside the penumbra see a partial solar eclipse. • Moon near perigee – ang diameter large + can cover sun's photosphere → total eclipse. • Moon near apogee – cannot fully cover photosphere → annular eclipse. • Total solar eclipse: Sun's bright photosphere – covered. • Faint low-density corona, chromosphere, + prominences can be seen. • Solar eclipses: New moon. • Lunar: Full moon. • Moon's orbit is inclined at a few degrees with respect to the plane of Earth's orbit – new moons cross above or below the Sun → no solar eclipses at this time. • Most full moons cross north or south of earths shadow → no lunar eclipses at this time. • Nodes: Moon's orbit crosses the ecliptic at 2 locations. • Ecliptic seasons: Eclipses happen when Sun + Moon are simultaneously near a node. – Occurs each time the line of nodes points toward the Sun.
Moons orbit	• The Moon orbits eastward around Earth once/month. • Moon seen because of reflected sunlight – changing

	appearance when orbiting Earth. – Sunlight illuminate different amounts of the side facing us → lunar phase cycle. • Elliptical orbit: – Angular size larger @ perigee. – Ang size smaller @ apogee. • Moon rotates on axis → same size facing earth → 59% of moon's surface visible. – Lunar libration: "Wobble" of the moon due to: 1. Moon moving at different speeds because of elliptical orbit. 2. Orbit inclined with respect to ecliptic. • Moon's orbit precesses → position of the nodes changes slowly over the year. – Nodes slip Westward along the ecliptic. – Eclipse year: It takes the Sun only about 347 days to go from a node around the ecliptic and back to the same node. – Therefore eclipse seasons begin about 19 days earlier each year.