HACETTEPE UNIVERSITY
DEPARTMENT OF GEOMATICS ENGINEERING

GMT327

ORBITAL MECHANICS and ASTRONOMY

HOMEWORK -1

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1)

Astronomy differs from most sciences is that it is primarily observational rather than experimental. Our knowledge of the Universe is obtained by analysis the information we obtain from space. Most of this is in the form of light. Earth's atmosphere has an effect on astronomical observations. While the atmosphere protects us from harmful radiation from the sun, it can also adversely affect the positions of celestial objects.

The apparent position of an object in the sky can be altered by several different physical effects. One of which is Atmospheric Refraction.;

Light is refracted by the Earth's atmosphere, due to refraction the height of the celestial body increases. The refraction depends on your altitude, atmospheric conditions and the wavelength of the observation. According to my search, the speed of light changes as it passes through a medium such as air. The speed of light in air depends on its temperature and pressure, so the refractive index of air varies in different parts of the atmosphere. Because the atmosphere refracts the light, the position and clarity of the celestial body is less accurate. Atmospheric refraction and the distance of the celestial body cause the object to appear bright, which has a direct effect on the object's precise position. Also, Natural pollution is a factor in the refraction of light, that is, it comes from volcanoes and gases from the mantle that pass through the Earth's crust to the atmosphere. Volcanish ash not only covers the sky and travels the earth, it also refracts light significantly.

As another atmospheric error, I can say Scattering and Weather Condition ;

The wavelength of light is the same size as the diameter of the scattered particles, so the scattering of light is strongest. The atmosphere is in constant motion from Earth's weather. While weather causes clouds to obscure vision, it also affects the atmosphee's ability to scatter light from the Sun. For example, in cloudy, dusty or foggy weather, light cannot easily pass through the atmosphere and is scattered easily, which may cause erros in the coordinates of the observed celestial body.

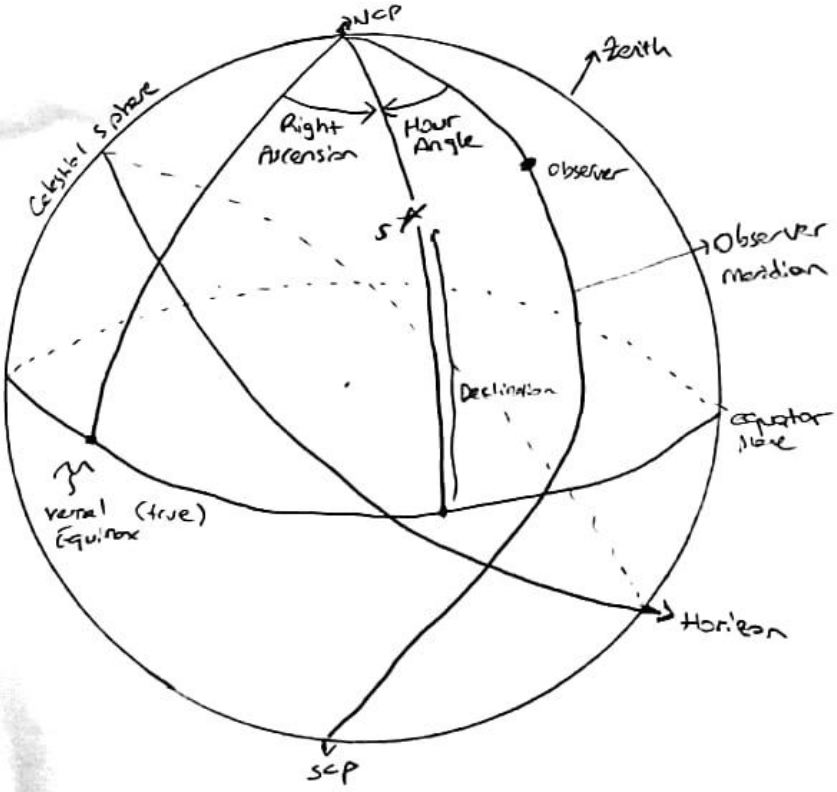
Finally, Astronomical Aberration ;

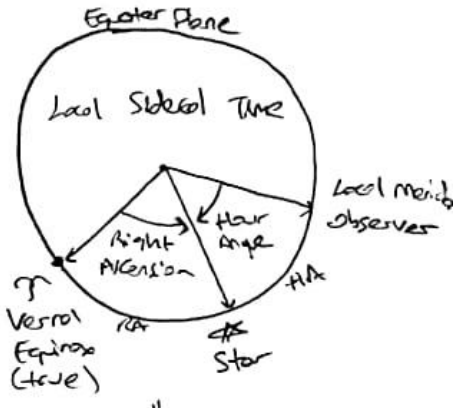
In astronomy, aberration has been defined as a phenomenon that produces an apparent motion about the true positions of celestial bodies, depending on the observer's speed. It causes objects to appear to be displaced in the direction of the observer's motion, compared to when the observer is stationary. Actually, I cannot say that the aberration is directly the effect of the atmosphere, but I think tat the distance of the moving celestial body (depending on the speed of the Earth) and the angle difference between the reflected light and the object will deviate more due to atmosphere (weather condition).

As mitigation techniques, I can say that the places to be observed should be suitable for the atmospheric field conditions and the construction should be done accordingly, because the increase in both temperature and atmospheric water means that the quality of observation will decrease greatly, which will cause deteriorations in the coordinates of the observed object and decrease the observation time.
In addition, I learned that observations from Earth are usually made above sea level, so there is less atmosphere between the telescope and the object being observed, and the effect is lessened.

2)

- To find the position of a star we need to find out how the Hour Angle changes over time. Hour Angle shows how far the star is from the observer's meridian, so Hour Angle is the angular distance from the observers meridian to the star meridian.
- Right Ascension is the astronomical equivalent of longitude, it is the angular distance from the vernal equinox in the equatorial plane to star meridian.
- LAST (Local Apparent Sidereal Time) is the horizontal distance between the observer and vernal equinox,
  So we can get Right Ascension with the difference between LAST and Hour Angle (HA). $\Rightarrow$ RA = LAST - HA





$$LAST = RA + HA$$

$$\boxed{RA = LAST - HA}$$

- RA: Right Ascension
- HA: Hour Angle
- LAST: Local Apparent Sidereal Time