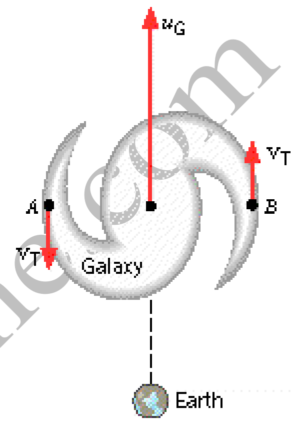
Q- A distant galaxy is simultaneously rotating and receding from the earth. As the drawing shows, the galactic center is receding from the earth at a relative speed of $u_G = 1.8 \times 10^6$ m/s. Relative to the center, the tangential speed is $v_T = 0.3 \times 10^6$ m/s for locations *A* and *B*, which are equidistant from the center. When the frequencies of the light coming from regions *A* and *B* are measured on earth, they are not the same and each is different than the emitted frequency of 6.400×10^{14} Hz. Find the measured frequency for the light from each of the following.

(a) region *A*

(b) region *B*



The frequency of light from a moving source is not as that of the actual one but apparent and given by Doppler's formula for approaching source

$$n' = n\left(\frac{c}{c-v}\right)$$

If the source is receding away it is

$$n' = n\left(\frac{c}{c+v}\right)$$

Here c is the speed of light and v is the velocity of approach of the source

(a) For point A which is moving away with resultant velocity u - v we have

$$n_1 = n\left(\frac{c}{c+(u-v)}\right) = 6.4*10^{14}\left(\frac{3*10^8}{3*10^8+(1.8-0.3)*10^6}\right) = 6.3682*10^{14}\,Hz$$

(b) And as the region B is receding away with a velocity v + u we have

$$n_2 = n\left(\frac{c}{c+(u+v)}\right) = 6.4*10^{14}\left(\frac{3*10^8}{3*10^8+(1.8+0.3)*10^6}\right) = 6.3555*10^{14}\,Hz$$