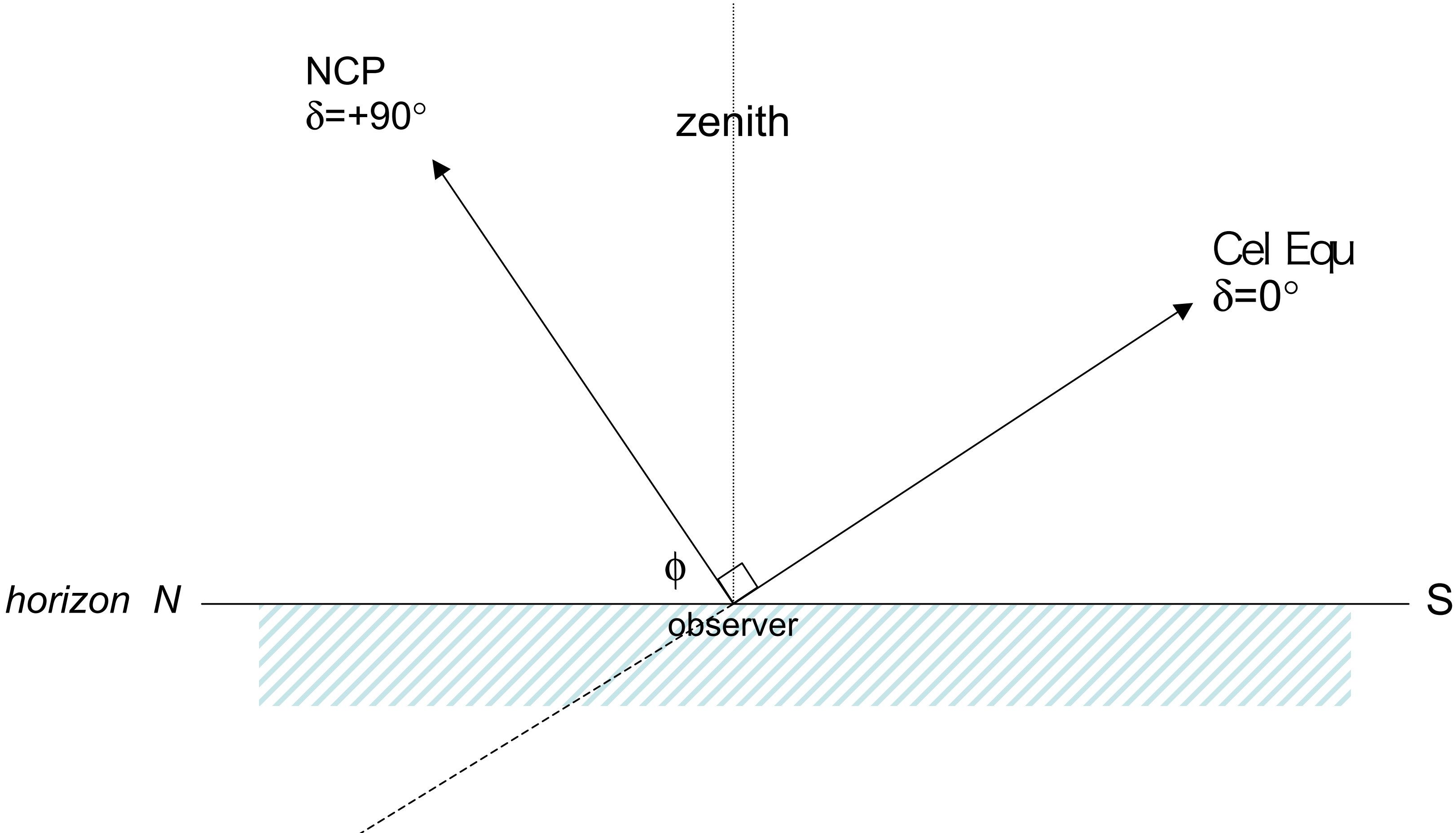
$$B_\nu(T) = \frac{2h\nu^3}{c^2} \frac{1}{e^{h\nu/kT} - 1}$$

Small $h\nu / kT$ : $e^{h\nu/kT} \simeq 1 + \frac{h\nu}{kT}$. So:

$$B_\nu(T) \simeq \frac{2h\nu^3}{c^2} \frac{1}{1 + \frac{h\nu}{kT} - 1} = \frac{2h\nu^3}{c^2} \frac{kT}{h\nu} = \frac{2kT\nu^2}{c^2}.$$

Note that h, Planck's constant, disappears. This implies that quantum mechanics is not needed to derive this formula, which is a correct statement: the Rayleigh-Jeans formula was derived some time before the Planck formula was discovered.

# 121.




$\delta$ = declination, $\phi$=latitude

- we showed in class that latitude=altitude of NCP
- once you know declination of an object, you can figure out where it is relative to Cel Equ and NCP

# 121 cont'd

(a) We showed in class that the altitude of the NCP is just the observer's latitude. If latitude $\varphi$=48d, then the altitude of the NCP is simply 48d. It's labelled in the figure so that's a give-away.

(b) Stars that are just circumpolar skim the horizon in the figure, so they are 48d from the NCP. Now the NCP is at dec=+90d, so these stars are at dec=90-48=+42d.

(c) The ecliptic is inclined to the celestial Equator by 23.5d. That means that the sun is at most 23.5d N of the cel equ (June 21) and at most 23.5d S of the cel equ (Dec 21). Looking at the diagram and adding up the angles, you can see that the cel equ is 90-$\varphi$=42d above the horizon. That means that on Jun 21 the sun is 42+23.5=65.5d above the horizon, and on Dec 21 the sun is 42-23.5=18.5d above the horizon.

# 122.

The figure says that the sun is mag -26.7 and the faintest star mag +30. We then have:

$\frac{\ell_{ft}}{\ell_{\odot}} = 10^{-0.4(m_{ft} - m_{\odot})}$, where I'm using the symbol $\odot$ for the sun.

(The only reason I don't use this in class is that this symbol can be hard to find in power point!)

OK, $\frac{\ell_{ft}}{\ell_{\odot}} = 10^{-0.4(30-(-26.7))} = 2.1 \times 10^{-23}$. Or, the faint star is $4.8 \times 10^{22}$ times fainter than the sun.