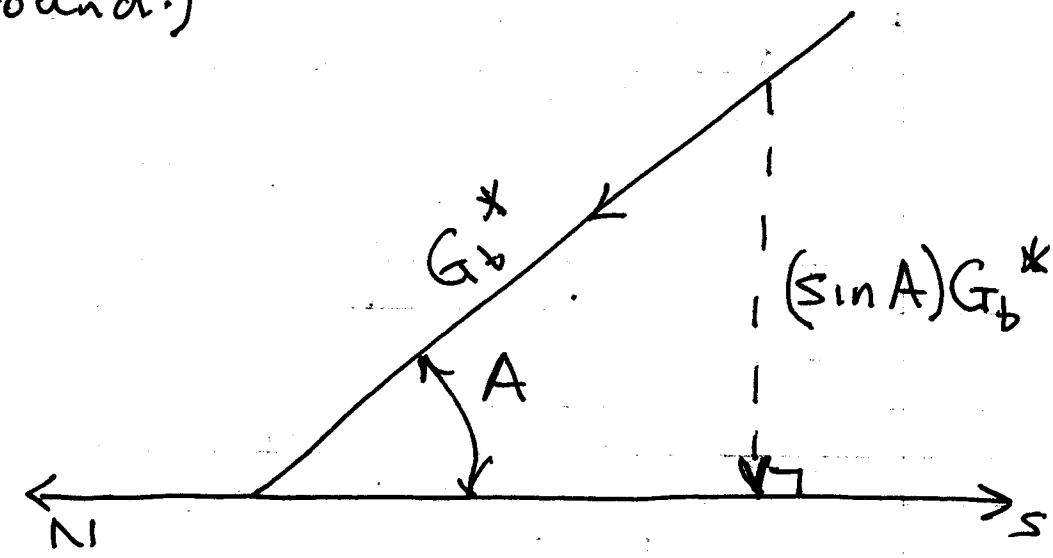
Addendum to Lecture #8

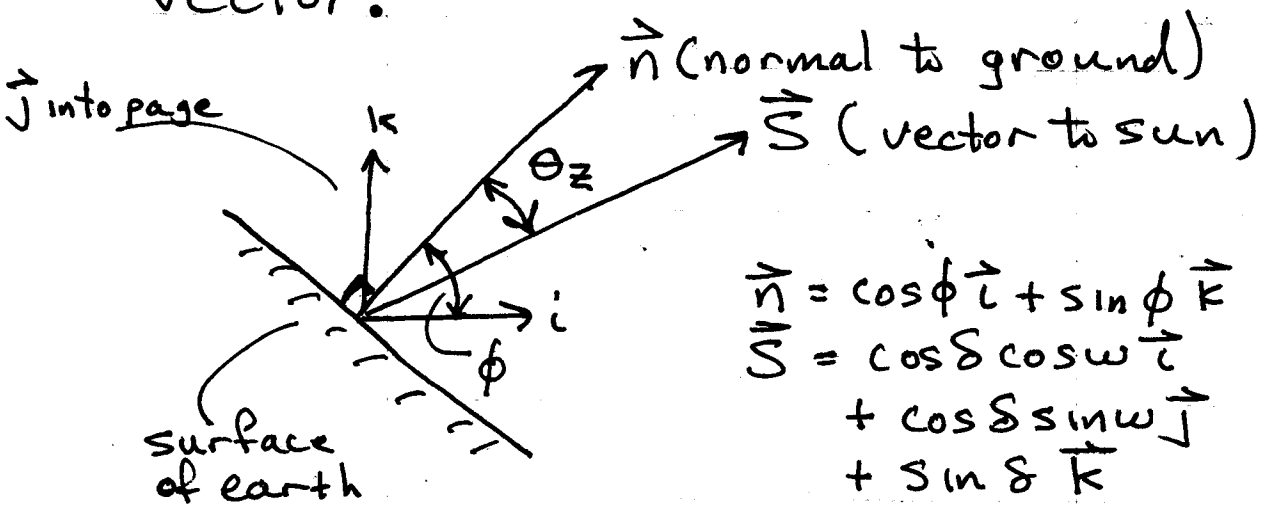
Trough collectors are rotated about N-S axes. Thus, we need to have an equation for the angle between the sun beam and the N-S axis. (The N-S axis is parallel to the horizontal ground.)



The collector is rotated so that its aperture is normal to the solar beam component $(\sin A)G_b^*$.

What is the expression for angle A?

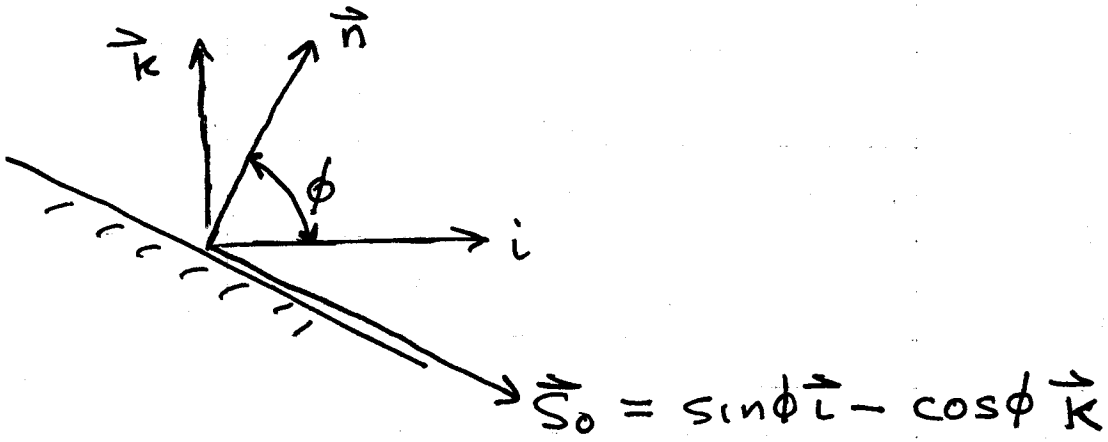
We look back at the addendum to Lecture #4. There we developed two vectors: one for the normal to the ground, and the other for the sun beam. The dot-product of these two vectors gave us $\cos\theta_z$. We do almost the same thing now, though we need the south-direction vector.

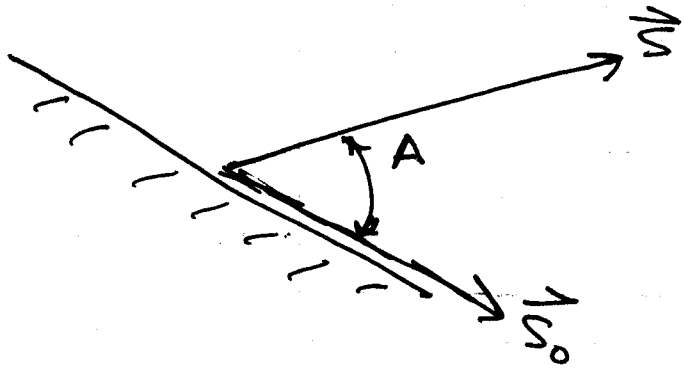


$$\vec{n} = \cos\phi\,\vec{i} + \sin\phi\,\vec{k}$$

$$\vec{S} = \cos\delta\cos\omega\,\vec{i} + \cos\delta\sin\omega\,\vec{j} + \sin\delta\,\vec{k}$$

The south-direction vector is





The dot product of $\vec{S} \cdot \vec{S}_o$

$$= \boxed{\sin\phi \cos\delta \cos\omega - \cos\phi \sin\delta = \cos A}$$

This is the angle expression we need!

Note: at solar noon: $A = 90 - \theta_z$.