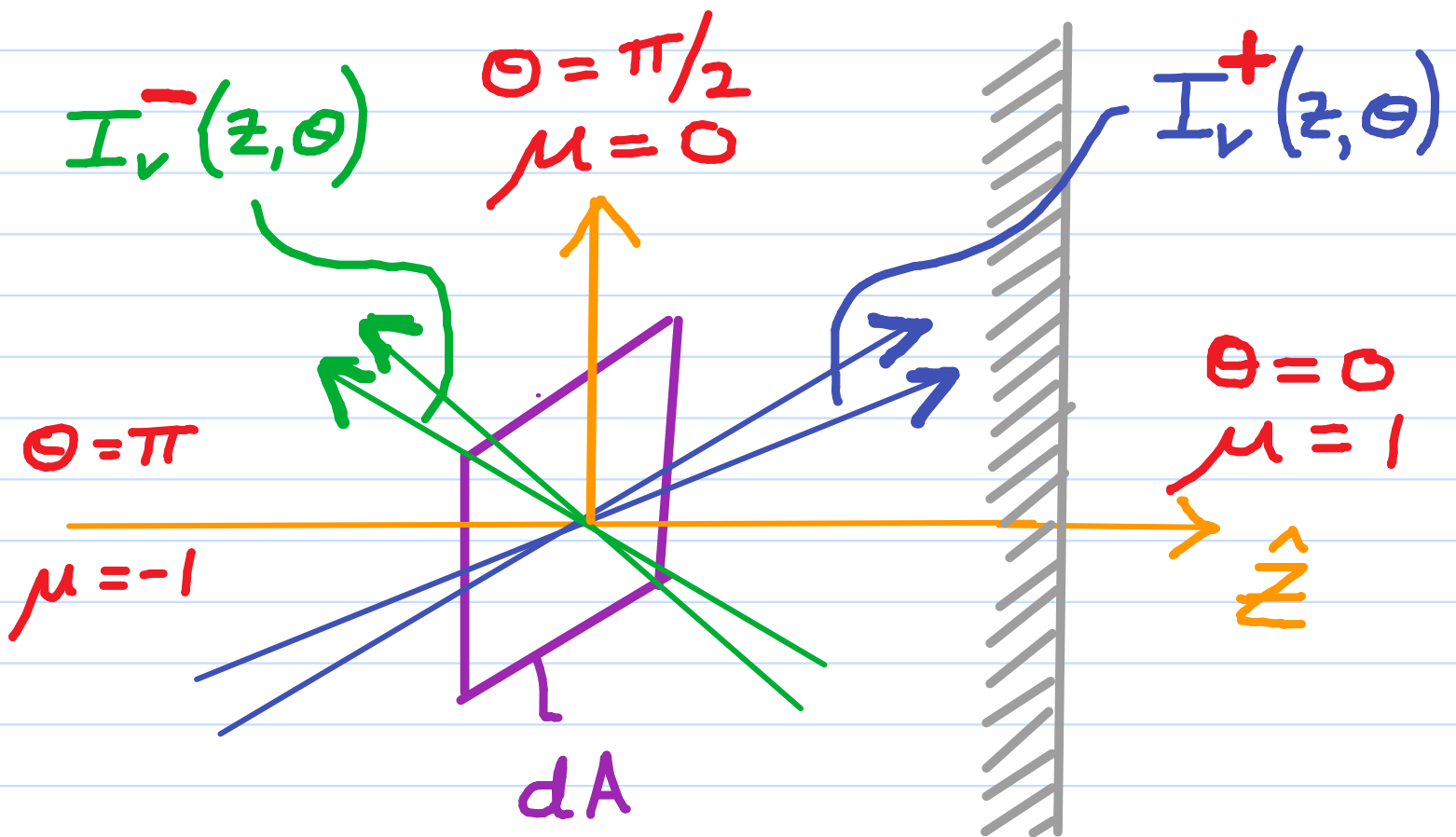


MONOCHROMATIC PHYSICAL FLUX
 $F_\nu(\vec{r}, t, \nu)$ (erg/s/cm²/Hz)

- ANGLE-WEIGHTED ANGLE-SUM
OF $I_\nu(\vec{r})$

F_ν IS NET E_ν PROPAGATING \perp
TO dA

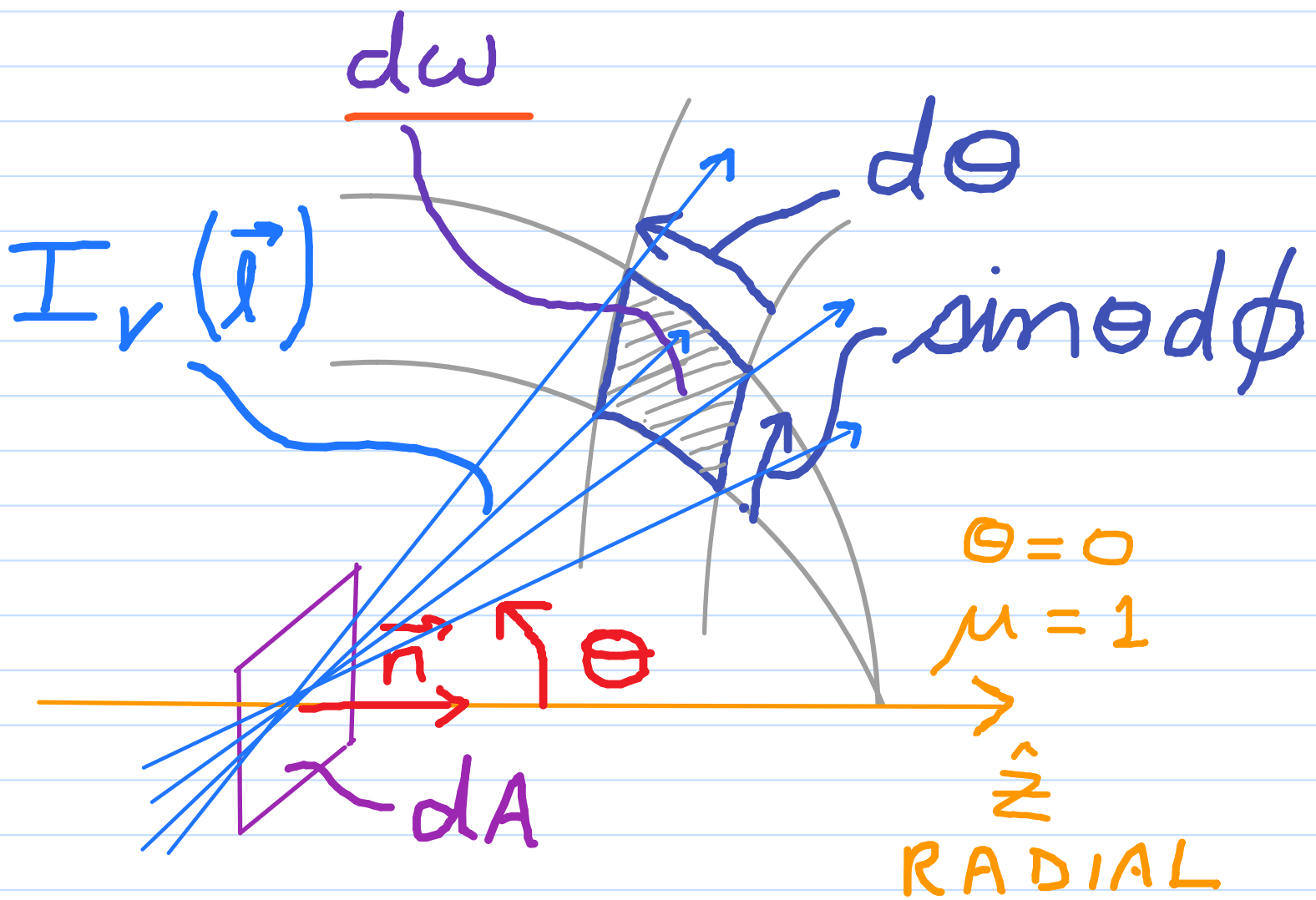


$$I_{\nu}^{+} = \text{OUT-GOING } I_{\nu} \\ (0 < \theta < \pi/2, \quad 0 < \mu < 1)$$

$$I_{\nu}^{-} = \text{IN-COMING } I_{\nu} \\ (\pi/2 < \theta < \pi, \quad -1 < \mu < 0)$$

$$\text{WEIGHT} = \cos \theta \equiv \mu$$

$$F_{\nu}(\vec{r}) = \oint_0^{4\pi} I_{\nu}(\vec{r}, \vec{l}) \cdot \underline{\cos \theta} \, d\omega \\ (\text{erg/s/cm}^2/\text{Hz})$$



$$\underline{d\Omega} = \sin\theta d\theta d\phi$$

$$F_r(\vec{r}) =$$

$$\int_{\phi=0}^{2\pi} \int_{\theta=0}^{\pi} I_r(\vec{r}, \theta, \phi) \cos\theta \sin\theta d\theta d\phi$$

1D AXI-SYMMETRIC MODEL:

$$I_v(\vec{r}, \theta, \phi) = I_v(\underline{z}, \theta):$$

$$\tilde{E}_v(\underline{z}) = \underline{2\pi} \int_{\theta=0}^{\pi} I_v(\underline{z}, \theta) \cos \theta \sin \theta d\theta$$

$$= 2\pi \int_0^{\pi/2} I_v^+(\underline{z}, \theta) \cos \theta \sin \theta d\theta$$

$$+ 2\pi \int_{\pi/2}^{\pi} I_v^-(\underline{z}, \theta) \cos \theta \sin \theta d\theta$$

IN 2nd INTEGRAL (I_v^-):

POLAR DIRECTION $\pi - \theta$ wrt -ve \hat{z}

$$\cos(\pi - \theta) = -\cos \theta$$

$$\sin(\pi - \theta) = \sin \theta$$

$$d(\pi - \theta) = -d\theta$$

$$\theta = \pi/2 \rightarrow \pi - \theta = \pi/2$$

$$\theta = \pi \rightarrow \pi - \theta = 0$$

$$F_v^+(z) = 2\pi \int_0^{\pi/2} I_v^+(z, \theta) \cos \theta \sin \theta d\theta$$

$$- 2\pi \int_0^{\pi/2} I_v^-(z, \pi - \theta) \cos \theta \sin \theta d\theta$$

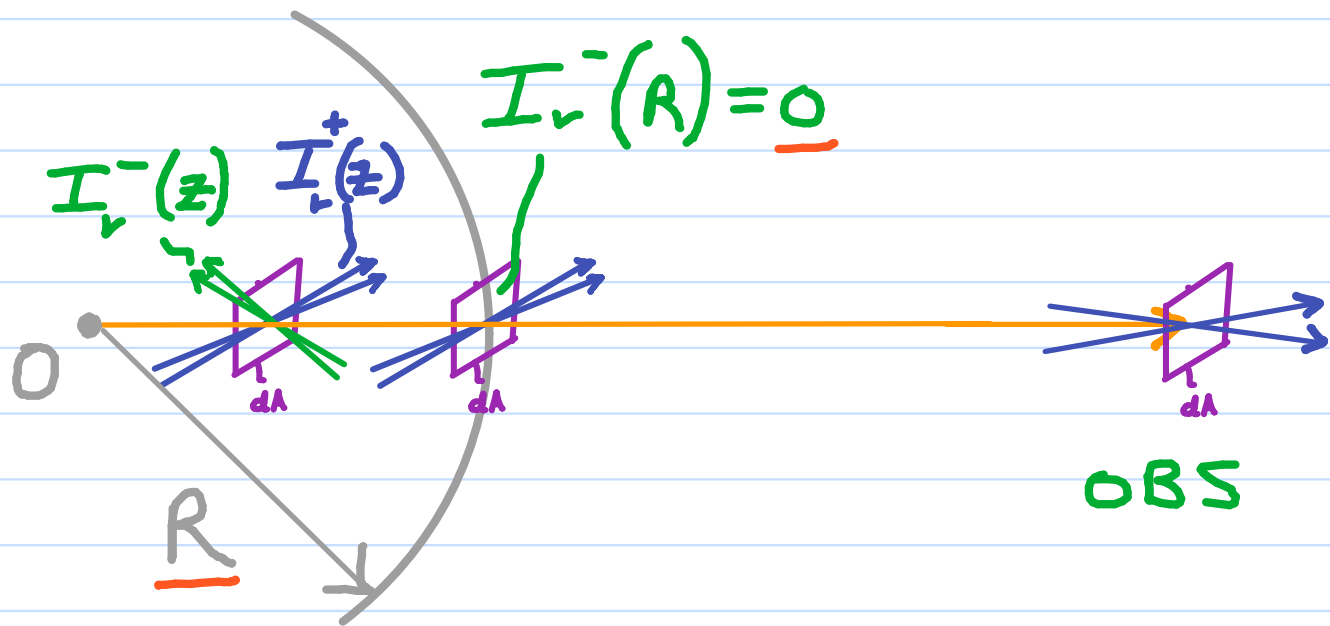
$$= F_v^+(z) - F_v^-(z)$$

$$\mu \equiv \cos \theta ; d\mu = -\sin \theta d\theta$$

$$K_{\nu}^+(z) = 2\pi \int_0^1 \mu I_{\nu}^+(z, \mu) d\mu$$

$$\uparrow \quad \int_0^1 \mu I_{\nu}^-(z, \mu) d\mu$$

SPECIAL CASES:



1) SURFACE: $z = R$:

$$I_v^-(R) = 0 \quad \therefore F_v(R) = F_v^+(R)$$

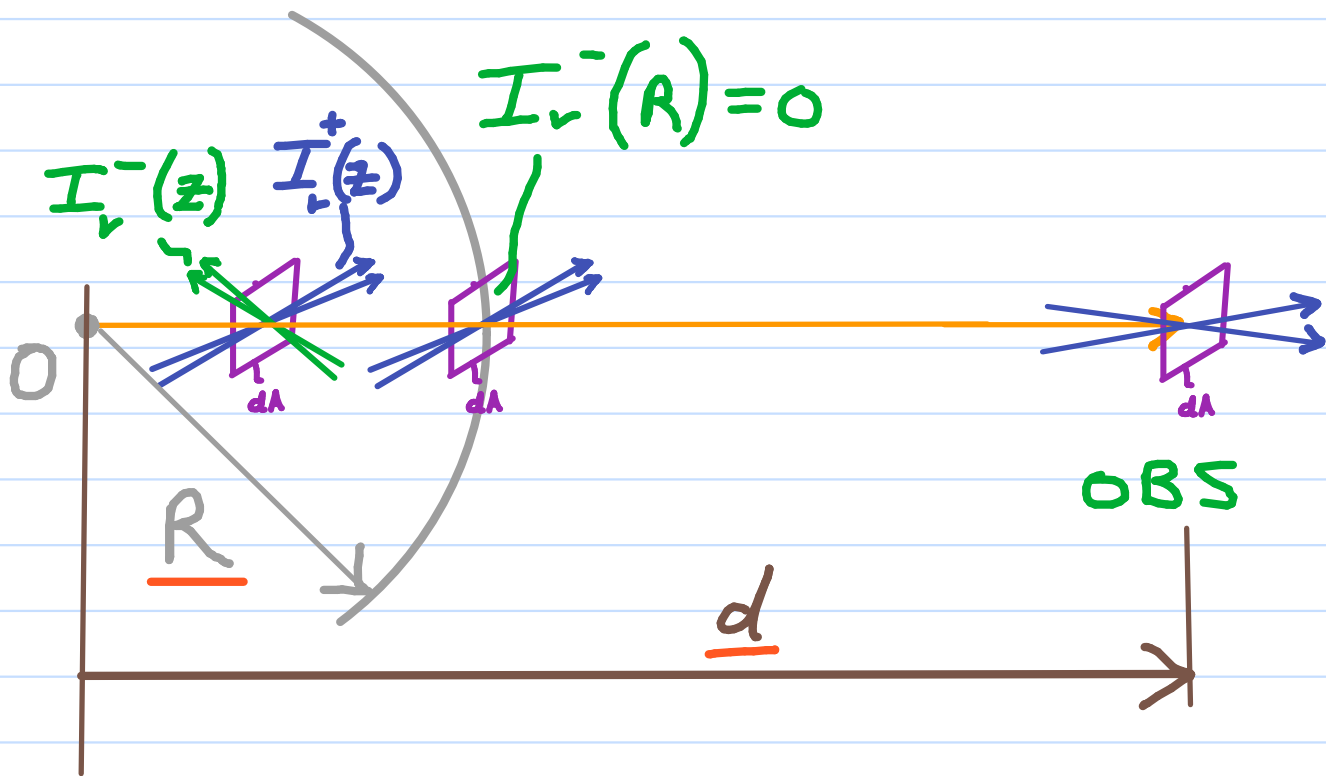
$$= 2\pi \int_0^1 \mu I_v^+(z, \mu) d\mu$$

BOLOMETRIC SURFACE FLUX, F :

$$\underline{F} \equiv F(R) = \int_{\nu=0}^{\infty} F_\nu(R) d\nu = \sigma T_{eff}^+$$

INPUT

SPECIAL CASES:



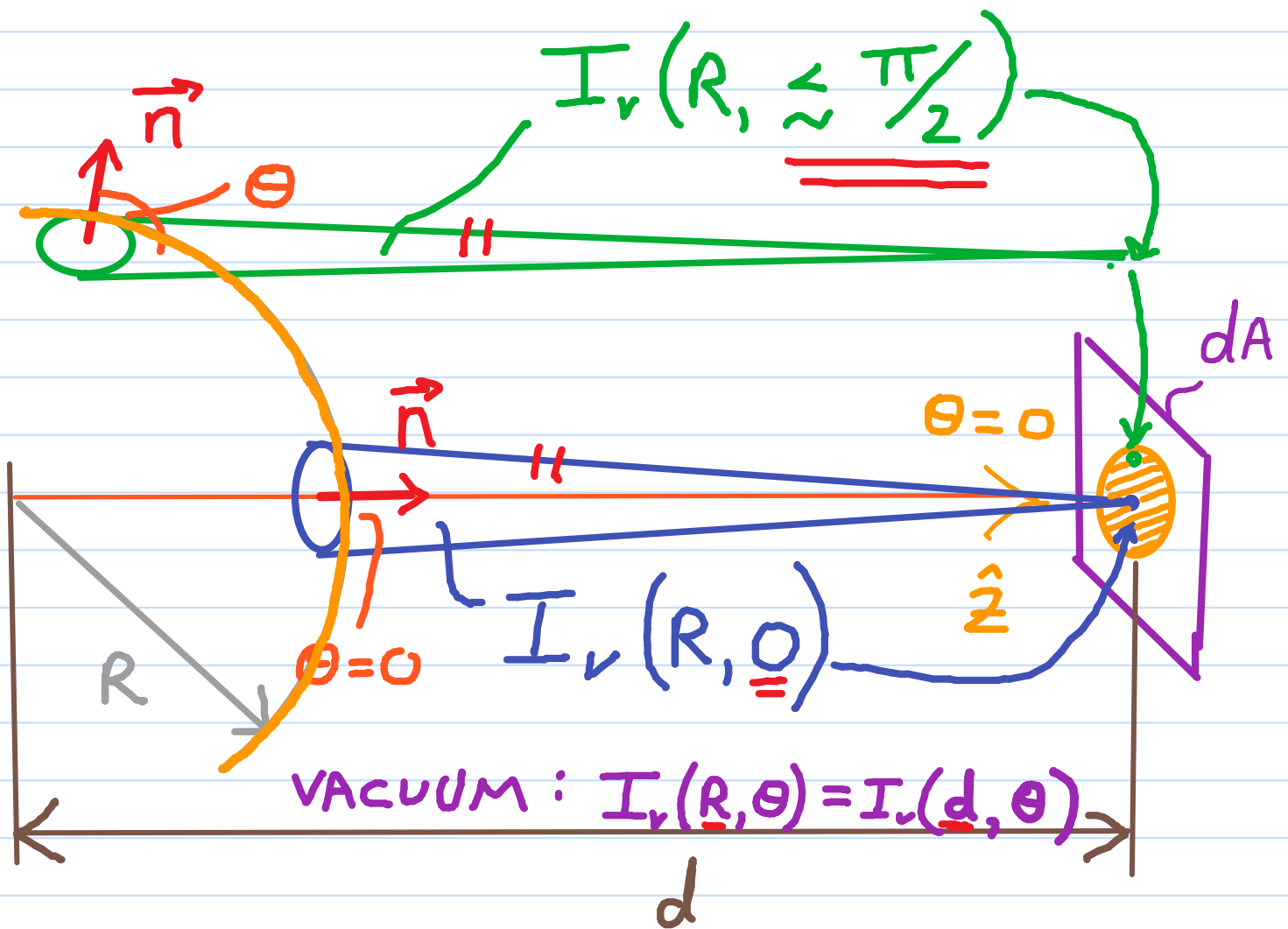
2) FLUX AT EARTH, $f_{\nu} : z = d$:

$$\underline{f_{\nu}} \equiv \underline{F_{\nu}^{+}(d)} = \frac{R^2}{d^2} F_{\nu}(R)$$

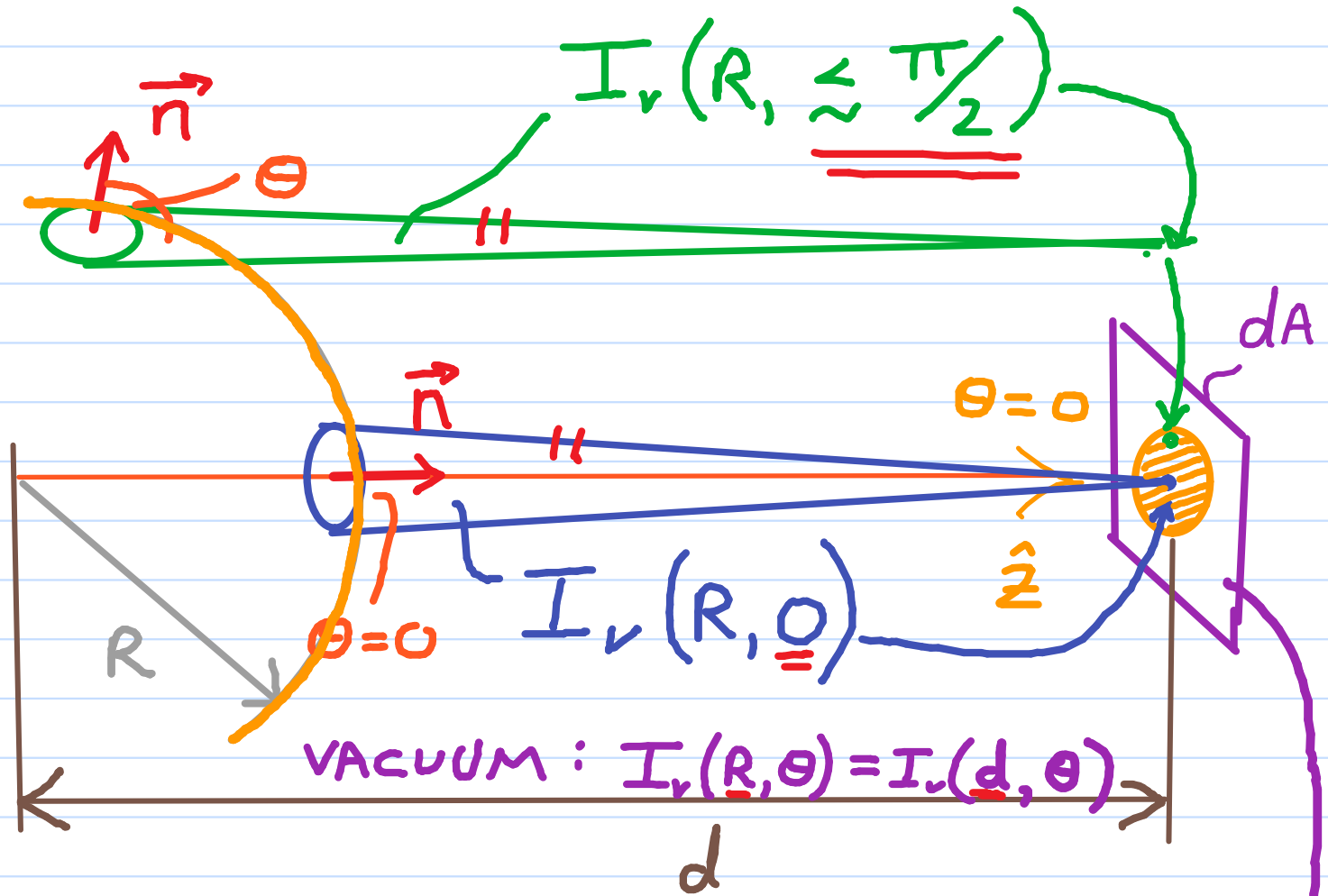
I_ν vs F_ν :

eg. SUN ($R \approx 10^{-2} d$)

SPATIALLY RESOLVED

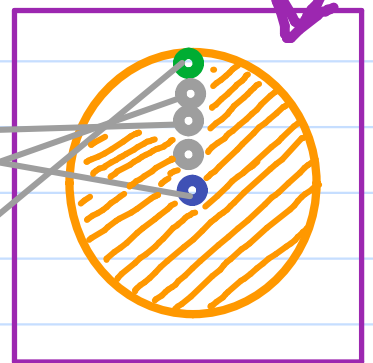
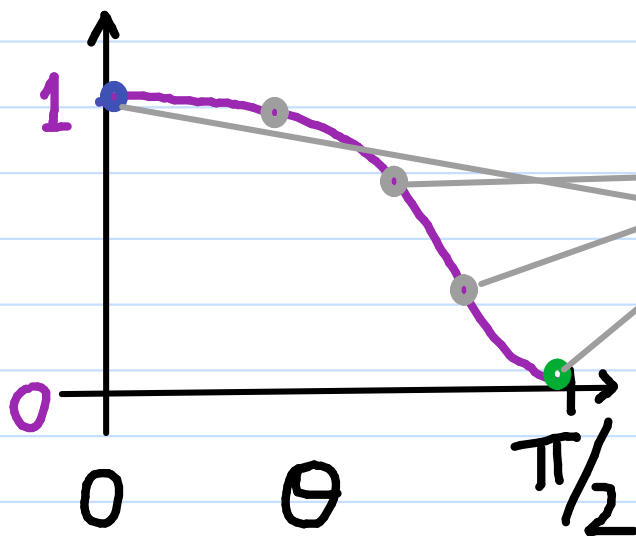


I_v vs f_v : Σ_g . SUN

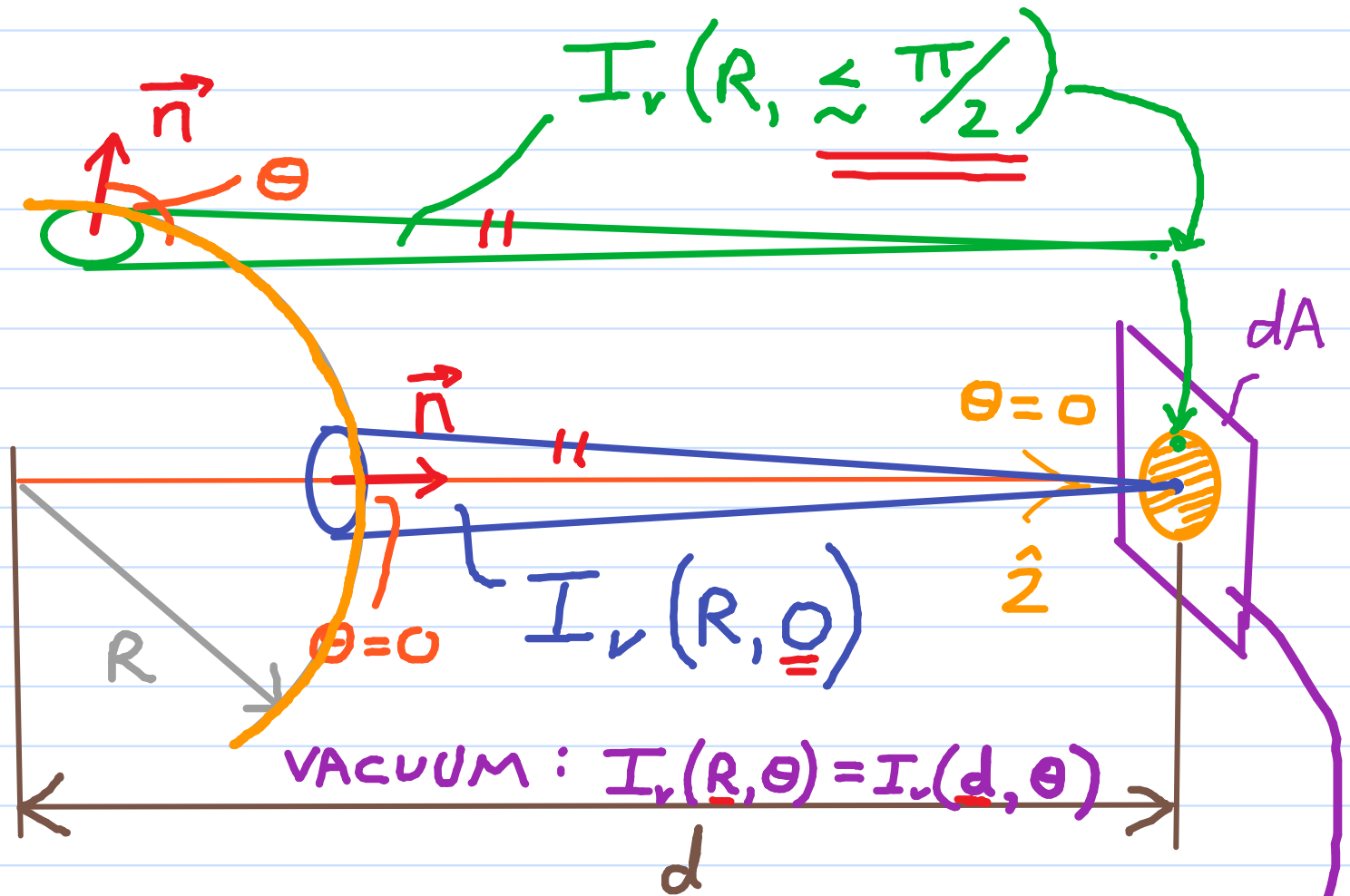


MEASURE:

$$\frac{I_v(R, \theta)}{I_v(R, 0)}$$



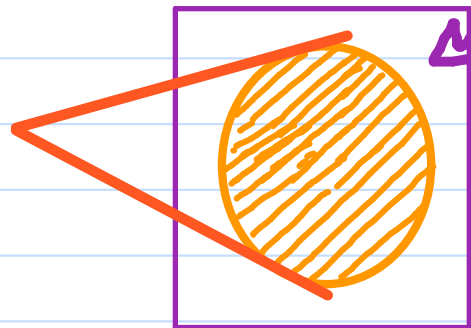
I_ν vs f_ν : Σ g. SUN



MEASURE:

$$\underline{f_\nu(d)} = \frac{R^2}{d^2} F^+(R)$$

$$f_\nu(z)$$

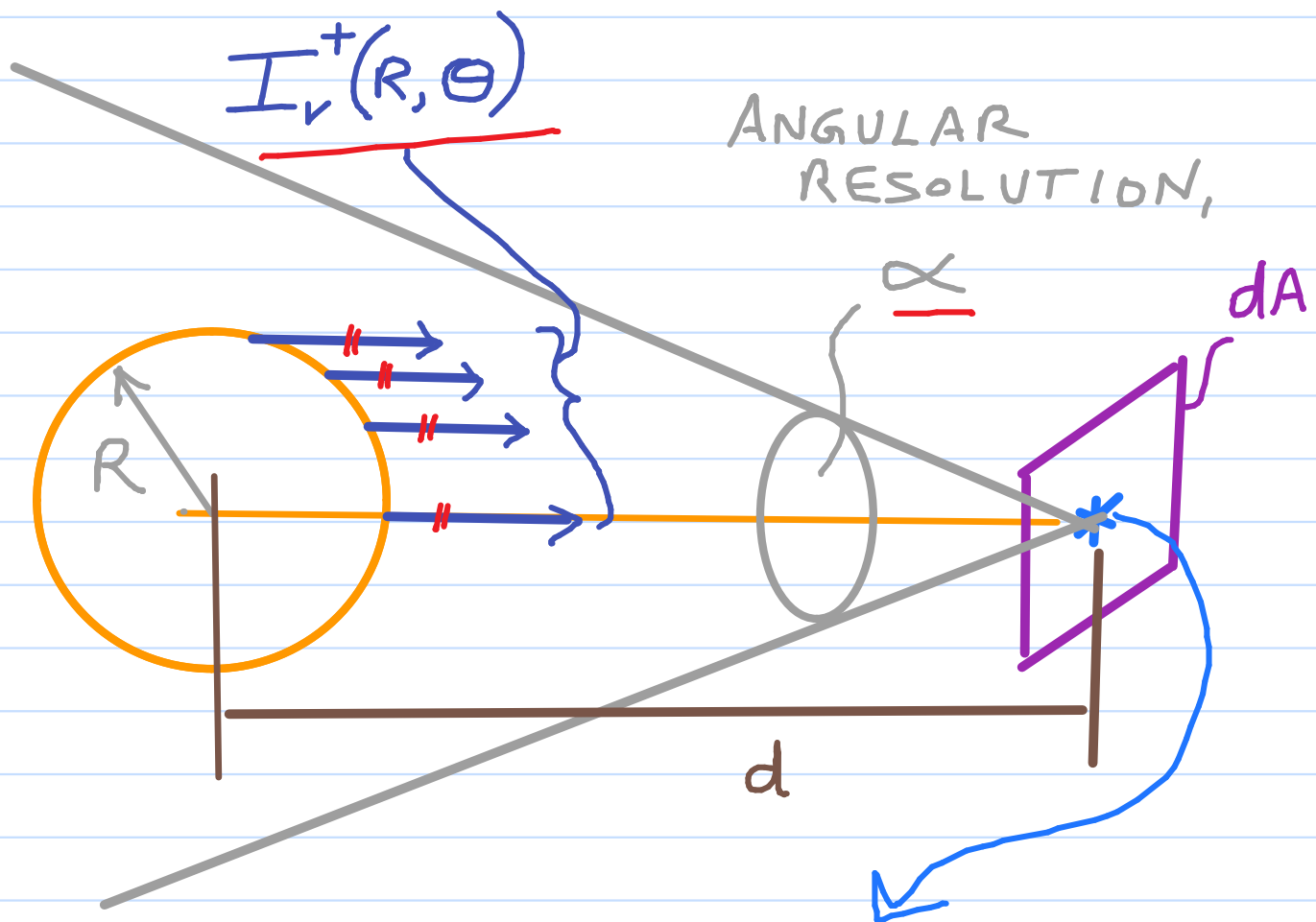


$$= 2\pi \int_{\mu=0}^1 \mu I_\nu^+(R, \mu) d\mu$$

I_ν vs f_ν :

eg. ANY OTHER STAR ($R \ll d$)

SPATIALLY UNRESOLVED
POINT SOURCE



MEASURE \rightarrow $f_\nu(d) = \frac{R^2}{d^2} F^+(R)$

$$= 2\pi \int_{\mu=0}^1 \mu I_\nu^+(R, \mu) d\mu$$