$$20 \times 12$$

$$(x, y)$$

$$(\phi, \theta)$$

$$(\phi_0, \theta_0)$$

$$(0, 0)$$

(α, δ)

δ_0

30°

$$\delta_0 = 0$$

α_0

50°

1

1,2

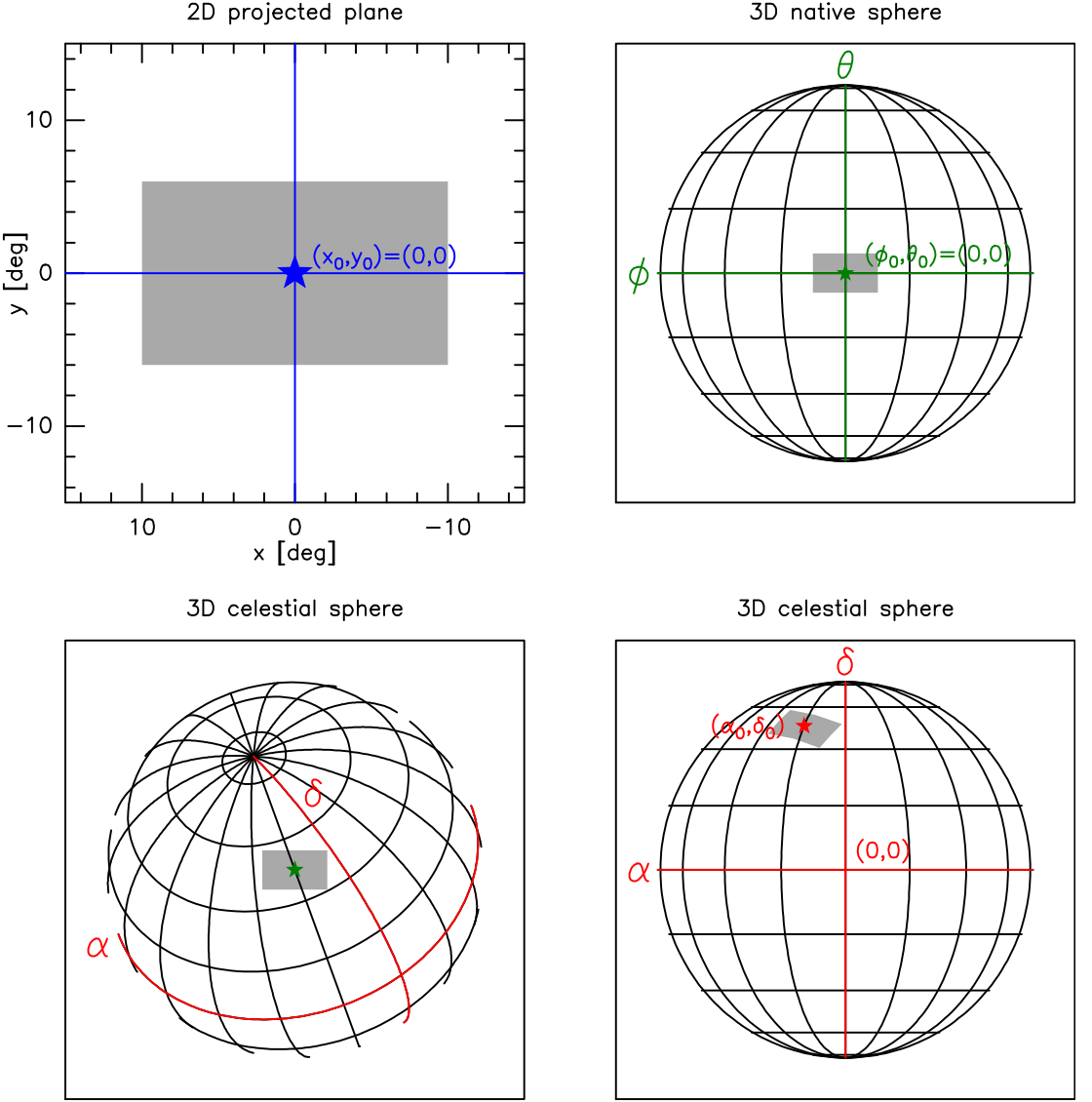
$$(x_0, y_0)$$

$$(0, \pm 90^\circ)$$

$$(\alpha_0, \delta_0)$$

$$(\phi_p, \theta_p)$$

$$(\alpha_p, \delta_p)$$


2D projected plane
10
0
−10
y [deg]
10
0
−10
x [deg]
(x0,y0)=(0,0)
3D native sphere
θ
φ
(φ0,θ0)=(0,0)
3D celestial sphere
δ
α
3D celestial sphere
δ
(α0,δ0)
α
(0,0)

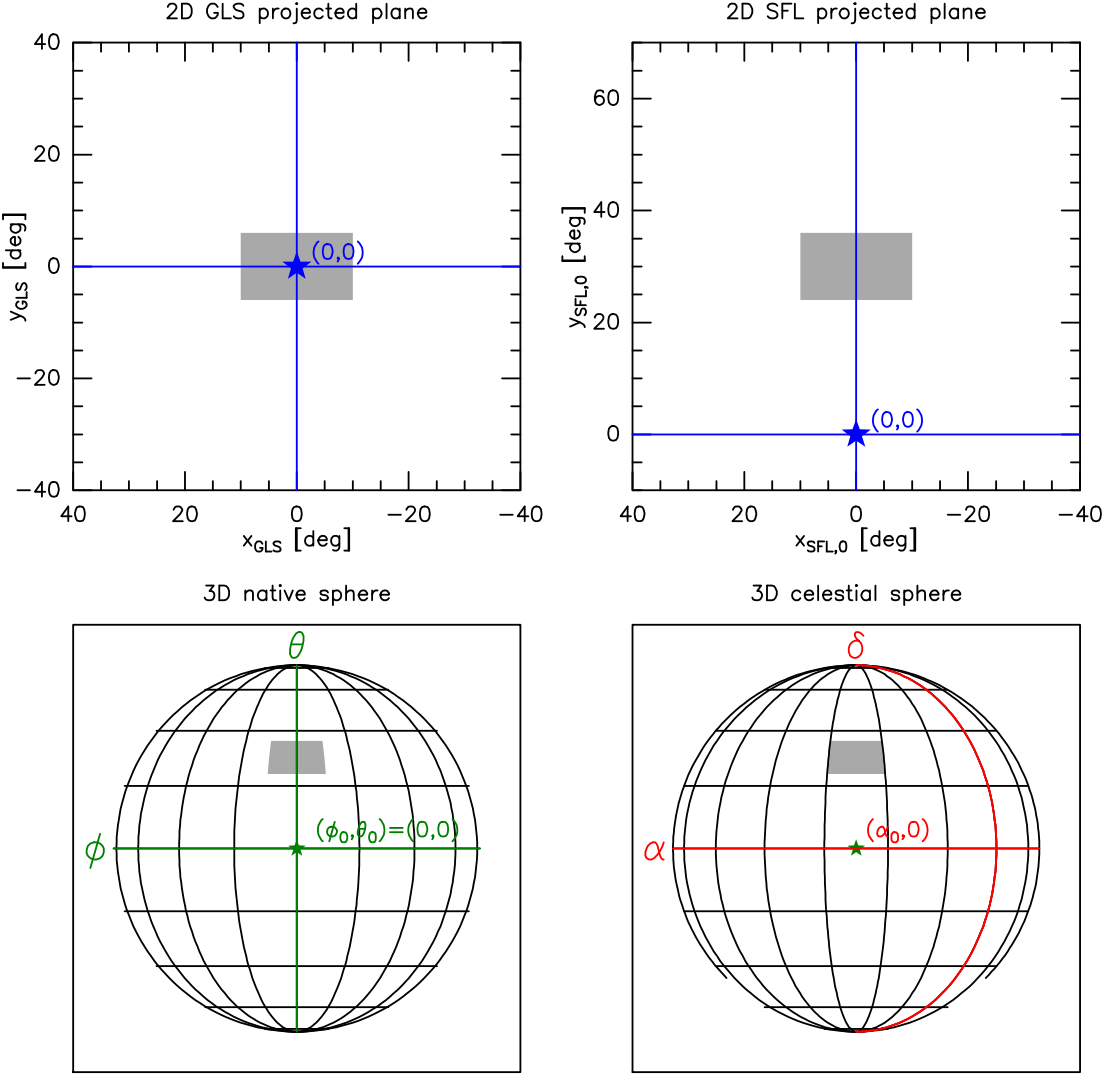
x

$$(\alpha - \alpha_0)\cos\delta,$$

y

$$\delta - \delta_0.$$

$$(\alpha, \delta) = (0, 0)$$


2D GLS projected plane
40
20
0
−20
−40
y_{GLS} [deg]
(0,0)
40
20
0
−20
−40
x_{GLS} [deg]
2D SFL projected plane
60
40
20
0
$y_{SFL,0}$ [deg]
(0,0)
40
20
0
−20
−40
$x_{SFL,0}$ [deg]
3D native sphere
θ
ϕ
$(\phi_0,\theta_0)=(0,0)$
3D celestial sphere
δ
α
$(\alpha_0,0)$

z

$$\sin\delta\cos\delta_0 - \cos\delta\sin\delta_0\cos(\alpha - \alpha_0)$$

θ

$$\cos^{-1}((\sin\delta - z\cos\delta_0)/\sin\delta_0)$$

r

$$\tan \frac{\theta}{2}$$

$$r \sin p$$

$r \cos p$

z

r

p

θ

$$\cos\theta = \sin\delta \sin\delta_0 + \cos\delta \cos\delta_0 \cos\Delta\alpha$$

$$r_{\mathrm{AIPS}} = 2\frac{\sin\theta}{1+\cos\theta}$$

$$r_{\mathrm{AIPS}} = 2 \tan \frac{\theta}{2}$$

$$\tan x = \frac{\sin x}{\cos x} = \frac{2\sin x\cos x}{2\cos^2 x} = \frac{\sin 2x}{1+\cos 2x}$$

$$\tan(\theta/2) \simeq \theta/2$$

$$r \simeq \theta/2$$

$$r \simeq \theta$$

-22000

$$(\alpha - \alpha_0) \times cos(\delta - \delta_0)$$

$$\delta - \delta_0$$

x

$$\delta - \delta_0$$

δ

$$(\phi_0, \theta_0) = (0, 0)$$

ϕ_p

$$\phi_p = \begin{cases} 0^\circ & \text{for } \delta_0 \geq 0 \\ 180^\circ & \text{for } \delta_0 < 0 \end{cases}$$

$$\sin \phi_p = 0$$

$\delta_{p,1}$

$$(0, \cos\phi_p) + \cos^{-1}(\sin\delta_0)$$

$\delta_{p,2}$

$$(0, \cos\phi_p) - \cos^{-1}(\sin\delta_0)$$

$$(y, x)$$

$\delta_{p,1}$

$\delta_{p,2}$

δ_p

θ_p

$$\delta_p = \begin{cases} \delta_{p,1} & \text{if } \delta_{p,1} > 0 \text{ and } \delta_{p,1} \leq 90^\circ \\ \delta_{p,2} & \text{otherwise.} \end{cases}$$

$$\delta_p = \pm 90^\circ$$

α_p

$$\alpha_p = \begin{cases} \alpha_0 + \phi_p - 180^\circ & \text{for } \delta_p = +90^\circ \\ \alpha_0 - \phi_p & \text{for } \delta_p = -90^\circ \\ \alpha_0 - \operatorname{atan2}(0, -\frac{\sin\delta_p \sin\delta_0}{\cos\delta_p \cos\delta_0}) & \text{otherwise.} \end{cases}$$

ϕ

$$\frac{x}{\cos y}$$

α

$\alpha_p +$

$$(-\cos\theta\sin(\phi-\phi_p), \sin\theta\cos\delta_p - \cos\theta\sin\delta_p\cos(\phi-\phi_p))$$

δ

$$\sin^{-1}(\sin\theta\sin\delta_p + \cos\theta\cos\delta_p\cos(\phi - \phi_p))$$

$\phi_p +$

$$(-\cos\delta\sin(\alpha-\alpha_p), \sin\delta\cos\delta_p - \cos\delta\sin\delta_p\cos(\alpha-\alpha_p))$$

$$\sin^{-1}(\sin\delta\sin\delta_p + \cos\delta\cos\delta_p\cos(\alpha - \alpha_p))$$

$$\phi \cos \theta$$

ϕ_p

0°

δ_p

$+90^\circ$

α_p

$$\alpha_0 - 180^\circ$$

$\phi_{\mathrm{SFL},0}$

$$\phi_{\mathrm{SFL},0} = \mathrm{atan2}(-\cos\delta\sin(\alpha-\alpha_0-180^\circ), -\cos\delta\cos(\alpha-\alpha_0-180^\circ)) = \alpha-\alpha_0$$

$$(-y, -x) =$$

$$(y, x) + 180^\circ$$

$\theta_{\mathrm{SFL},0}$

$$\theta_{\mathrm{SFL},0} = \sin^{-1}(\sin\delta) = \delta$$

$x_{\mathrm{SFL},0}$

$$(\alpha - \alpha_0)\cos\delta$$

$y_{\mathrm{SFL},0}$

x'

x

$$= (\alpha - \alpha_0) \cos \delta$$

y'

y

$$+\delta_0 = \delta$$

$(x'$

$, y'$

$$) = (x_{\mathrm{SFL},0}, y_{\mathrm{SFL},0})$$

x

$= x_{\mathrm{SFL},0}$

y

$$= y_{\mathrm{SFL},0} - \delta_0$$

$$(3600, -1800), (3600, +1800)$$

$$(-200, 0)$$

$$\delta_0 \neq 0$$