$\phi \in [0, 2\pi[$

$C(\ell)$

$B(\ell)$

$0 < |s| \leq 100$

$\ell < 46340$

$\partial X / \partial \theta$

$$\partial^2 X/(\partial\theta\partial\phi\sin\theta)$$

$\partial^2 X / \partial \theta^2$

$$C_{12}^{XY}(\ell) = \frac{1}{2\ell+1} \sum_{m=-\ell}^{\ell} a_{1,\ell m}^{X} a_{2,\ell m}^{Y*},$$

$$C^{\{XY\}}_{\{12\}}(\ell) \equiv \frac{C^{XY}_{12}(\ell) + C^{YX}_{12}(\ell)}{2} = \frac{C^{XY}_{12}(\ell) + C^{XY}_{21}(\ell)}{2}$$

C_ℓ^{EE}

C_ℓ^{BB}

C_ℓ^{TE}

$d \geq 6$

C_ℓ^{EB}

$d \geq 9$

C_ℓ^{ET}

$$C_\ell^{BE}$$

$d \geq 4$

$(C_\ell^{TE} + C_\ell^{ET})/2$

$(C_\ell^{TB} + C_\ell^{BT})/2$

$(C_\ell^{EB} + C_\ell^{BE})/2$

$\ell = 128$

$a^{E}_{\ell m}$

$$z = \sin(\text{latitude}) = \cos(\theta).$$

$(\partial T/\partial\theta, \partial T/\partial\phi/\sin\theta)$

$(\partial T/\partial\theta, \partial Q/\partial\theta, \partial U/\partial\theta;$

$\partial T/\partial\phi/\sin\theta, \ldots)$

$(\partial^2 T/\partial\theta^2, \partial^2 T/\partial\theta\partial\phi/\sin\theta,$

$\partial^2 T/\partial\phi^2/\sin^2\theta)$

$$(\partial^2 T/\partial\theta^2, \partial^2 Q/\partial\theta^2, \partial^2 Q/\partial\theta^2, \ldots)$$

$$ {}_sS(p) = \sum_{\ell m} {}_sa_{\ell m} \quad {}_sY_{\ell m}(p) $$

$\ell \geq |m|, \ell \geq |s|$

$${}_sY^*_{\ell m} = (-1)^{s+m}\,{}_{-s}Y_{\ell -m}$$

$${}_{s}a^{*}_{\ell m} = (-1)^{s+m}\,{}_{-s}a_{\ell -m}$$

$-({}_{|s|}a_{\ell m} + (-1)^s {}_{-|s|}a_{\ell m})/2$

$-({}_{|s|}a_{\ell m} - (-1)^s {}_{-|s|}a_{\ell m})/(2i)$

$m \geq 0$

$$(-1)^m {}_{|s|}\overline{a^*_{\ell m}}.$$

$$ {}_0a^{+}_{\ell m} = -a^{T}_{\ell m} $$

$$ {}_0S^+ = T $$

$$_0S^- = 0.$$

$$index = \ell^2 + \ell + m + 1$$

$a^{E}_{\ell m}$

$\ell_{\max} = m_{\max} = 128$

$$x = \sin\theta\cos\phi$$

$$y = \sin\theta \sin\phi$$

$$z = \cos\theta$$

$[0,\ \pi]$

$[0,\ 2\pi]$

$\cos^{-1}$

$$z = \sin(\text{latitude}) = \cos(\theta)$$

$|b| \leq 15^o$

Will print out:

```
--------------------
Number of OpenMP threads in use:  2
Number of CPUs available:  2
--------------------
```

on a bi-pro (or dual core) computer

$$m = \sum_i x_i / n$$

$$a = \sum_i |x_i - m| / n$$

$$\sigma^2 = \sum (x_i - m)^2 / (n - 1)$$

σ

$$s = \sum (x_i - m)^3 / (n\sigma^3)$$

$$k = \sum (x_i - m)^4 / (n\sigma^4) - 3$$

Will return:

```
a
bbbbbbbb
C 10 3
```

convert_nest2ring

convert_ring2nest

ψ, θ, φ

$\ell \leq 4N_{\mathrm{side}}$

C_ℓ^{EE}

C_ℓ^{BB}

C_ℓ^{TE}

C_ℓ^{EB}

C_ℓ^{ET}

$$C_\ell^{BE}$$

$\ell \leq 1024$

$2^{31} - 1 \simeq 2.1\ 10^9$

$2^{63} - 1 \simeq 9.2\ 10^{18}$

$\simeq 3.40\ 10^{38}$

$\simeq 1.80\ 10^{308}$

$\pi/2$

$\pi \simeq 3.14159\ldots$

2π

$\gamma \simeq 0.577\ldots$

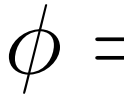
$1/\sqrt{4\pi}$

$\pi/180$

$180/\pi$

$-1.6375\ 10^{30}$

$\leq 4N_{\text{side}}$



10°

$$\mathbf{a}^{(n)} = \mathbf{a}^{(n-1)} + \mathbf{A}.\left(\mathbf{w}.\mathbf{m} - \mathbf{S}.\mathbf{a}^{(n-1)}\right),$$

$(\mathbf{w.m})$

$$\left(\mathbf{w.m} - \mathbf{S.a}^{(n-1)}\right)$$

$$\sigma \equiv \sqrt{\sum_{p=1}^{N} \frac{(x(p)-\bar{x})^2}{N-1}}$$

$$\bar{x} \equiv \sum_{p=1}^{N} \frac{x(p)}{N}$$

$$\mathbf{w}^2 \neq \mathbf{w}$$

$= -1.6375\ 10^{30}$

$$P^{\mathrm{T}}_{\ell m}$$

$\{1, \ldots, 2^{28}\}$

$$N_{\mathrm{side}} = \sqrt{N_{\mathrm{pix}}/12}$$

$\{1, \ldots, 2^{28} = 268435456\}$

$$\mathrm{N}_w = \frac{(N_{\mathrm{side}}+1)(3N_{\mathrm{side}}+1)}{4} \simeq \frac{N_{\mathrm{pix}}}{16}$$

$$\mathrm{N_{template}} = \frac{1+N_{\mathrm{side}}(N_{\mathrm{side}}+6)}{4}$$

$w_{\text{pix}}(\ell)$

$$a_{\ell m}^{(\mathrm{pix})} = a_{\ell m} w_{\mathrm{pix}}(\ell)$$

$\ell_{\max} \leq 4N_{\mathrm{side}}$

$$Y_{\ell m}(\theta, \phi) = \lambda_{\ell m}(\theta) e^{im\phi}$$

$3\pi/4$

$2^{128} - 1 \approx 3.410^{38}$

$\ell_{\max} = 64$

$$\propto 1/\sqrt{\mathrm{n\_obs}}$$

$$\sum_{j=0}^{d^2-1} A_{ij}\ f_j = b_i$$

$$b_i \equiv \sum_{p \in \mathcal{P}} s_i(p) w(p) m(p),$$

$$A_{ij} \equiv \sum_{p \in \mathcal{P}} s_i(p) w(p) s_j(p),$$

$$s_1(p) = x,\ s_2(p) = y,\ s_3(p) = z$$

$$m'(p) = m(p) - \sum_{i=0}^{d^2-1} f_i s_i(p).$$

$0\ldots$

$\ell \leq \ell_{\max}$

$\ell^3_{\max}$

$\ell_{\max} = m_{\max} = 64$

$\psi = \pi/3, \theta = 0.5, \varphi = 0$

$$z = \cos(\theta) \geq 2/3,$$

$$0 < \phi \leq \pi/2,$$

$$2/3 > z \geq 0,$$

$$\phi = 0, \quad \text{or} \quad \phi = \frac{\pi}{4N_{\text{side}}}.$$

$$2/3 > z \geq 0,$$

$$\phi = 0, \quad \text{or} \quad \phi = \frac{\pi}{4N_{\text{side}}}.$$

$$\mathbf{v}_3 = \mathbf{v}_1 \times \mathbf{v}_2$$

C_ℓ^E

$\propto 1024$