$$v(\mathbf{x})^{-2}\ddot{p}(\mathbf{x},t) - \nabla^2 p(\mathbf{x},t)$$

=

$w(\mathbf{x}, t);$

or $4\pi^2 f^2 s(\mathbf{x})^2 p(\mathbf{x}, f) + \nabla^2 p(\mathbf{x}, f)$

$$-w(\mathbf{x}, f).$$

p

X

v

S

w

f

$-i2\pi$

G

$$4\pi^2 f^2 s(\mathbf{x})^2 G(\mathbf{x}, \mathbf{x}', f)$$

+

$$\nabla^2 G(\mathbf{x}, \mathbf{x}', f) = -\delta(\mathbf{x} - \mathbf{x}'),$$

so that $p(\mathbf{x}, f)$

$$\iiint G(\mathbf{x}, \mathbf{x}', f) w(\mathbf{x}', f) d\mathbf{x}'.$$

$$4\pi^2 f^2 s(\mathbf{x})^2 \Delta G(\mathbf{x}, \mathbf{x}', f) + \nabla^2 \Delta G(\mathbf{x}, \mathbf{x}', f)$$

$$-8\pi^2 f^2 s(\mathbf{x}) G(\mathbf{x}, \mathbf{x}', f) \Delta s(\mathbf{x}),$$

$$\Delta G(\mathbf{x}, \mathbf{x}'', f) = \iiint 8\pi^2 f^2 s(\mathbf{x}') G(\mathbf{x}, \mathbf{x}', f) G(\mathbf{x}', \mathbf{x}'', f) \Delta s(\mathbf{x}') d\mathbf{x}',$$

$$\frac{\partial G(\mathbf{x}, \mathbf{x}'', f)}{\partial s(\mathbf{x}')} = 8\pi^2 f^2 s(\mathbf{x}') G(\mathbf{x}, \mathbf{x}', f) G(\mathbf{x}', \mathbf{x}'', f).$$

$$\frac{\partial p(\mathbf{x}, f)}{\partial s(\mathbf{x}')}$$

$$\iiint \frac{\partial G(\mathbf{x}, \mathbf{x}'', f)}{\partial s(\mathbf{x}')} w(\mathbf{x}'', f) d\mathbf{x}''$$

$$\iiint 8\pi^2 f^2 s(\mathbf{x}') G(\mathbf{x}, \mathbf{x}', f) G(\mathbf{x}', \mathbf{x}'', f) w(\mathbf{x}'', f) d\mathbf{x}''.$$

$$\theta(\mathbf{x}, \mathbf{x}'', f)$$

$\equiv$

$\log G(\mathbf{x}, \mathbf{x}'', f)$, and

$$\frac{\partial \theta(\mathbf{x}, \mathbf{x}'', f)}{\partial s(\mathbf{x}')} G(\mathbf{x}, \mathbf{x}'', f)$$

$$\frac{\partial G(\mathbf{x}, \mathbf{x}'', f)}{\partial s(\mathbf{x}')},$$

$$\iiint \frac{\partial \theta(\mathbf{x}, \mathbf{x}'', f)}{\partial s(\mathbf{x}')} G(\mathbf{x}, \mathbf{x}'', f) w(\mathbf{x}'', f) d\mathbf{x}'',$$

where $\dfrac{\partial \theta(\mathbf{x}, \mathbf{x}'', f)}{\partial s(\mathbf{x}')}$

$$8\pi^2 f^2 s(\mathbf{x}') \frac{G(\mathbf{x}, \mathbf{x}', f) G(\mathbf{x}', \mathbf{x}'', f)}{G(\mathbf{x}, \mathbf{x}'', f)}.$$

$\mathbf{x}'$

$$x''$$

$w(\mathbf{x}'', f)$

$$\phi(\mathbf{x}, f)$$

$$\log p(\mathbf{x}, f)$$

$$\frac{\partial \phi(\mathbf{x}, f)}{\partial s(\mathbf{x}')}$$

$$\frac{\iiint 8\pi^2 f^2 s(\mathbf{x}')G(\mathbf{x},\mathbf{x}',f)G(\mathbf{x}',\mathbf{x}'',f)w(\mathbf{x}'',f)d\mathbf{x}''}{\iiint G(\mathbf{x},\mathbf{x}''',f)w(\mathbf{x}''',f)d\mathbf{x}'''}.$$

$$p(\mathbf{x}, f)$$

$$G(\mathbf{x}, \mathbf{x}', t)$$

$$u(\mathbf{x}, \mathbf{x}')\delta[t - \tau(\mathbf{x}, \mathbf{x}')]$$

or $G(\mathbf{x}, \mathbf{x}', f)$

$$u(\mathbf{x}, \mathbf{x}') \exp[-i2\pi f \tau(\mathbf{x}, \mathbf{x}')].$$

u

$\mathcal{T}$

$$p(\mathbf{x}, t) = \iiint u(\mathbf{x}, \mathbf{x}')w[\mathbf{x}', t - \tau(\mathbf{x}, \mathbf{x}')]d\mathbf{x}'.$$

$$\left|\boldsymbol{\nabla}\tau(\mathbf{x},\mathbf{x}')\right|^2 = s(\mathbf{x})^2,$$

$$\nabla^2 u(\mathbf{x}, \mathbf{x}')$$

$$-\delta(\mathbf{x} - \mathbf{x}')$$

and $2\boldsymbol{\nabla}\tau(\mathbf{x},\mathbf{x}') \cdot \boldsymbol{\nabla}u(\mathbf{x},\mathbf{x}')$

$$u(\mathbf{x}, \mathbf{x}')\nabla^2\tau(\mathbf{x}, \mathbf{x}') = 0.$$

∇

∇^2

$$|\nabla v(\mathbf{x})| \ll 2\pi\, |f|\,.$$

$$\frac{\partial\theta(\mathbf{x},\mathbf{x}'',f)}{\partial s(\mathbf{x}')}$$

$$8\pi^2 f^2 s(\mathbf{x}') \frac{u(\mathbf{x},\mathbf{x}')u(\mathbf{x}',\mathbf{x}'')}{u(\mathbf{x},\mathbf{x}'')} \exp\{-i2\pi f[\tau(\mathbf{x},\mathbf{x}') + \tau(\mathbf{x}',\mathbf{x}'') - \tau(\mathbf{x},\mathbf{x}'')]\},$$

$$\frac{\partial \theta(\mathbf{x}, \mathbf{x}'', t)}{\partial s(\mathbf{x}')}$$

$$-2s(\mathbf{x}')\frac{u(\mathbf{x},\mathbf{x}')u(\mathbf{x}',\mathbf{x}'')}{u(\mathbf{x},\mathbf{x}'')}\ddot{\delta}[t-\tau(\mathbf{x},\mathbf{x}')-\tau(\mathbf{x}',\mathbf{x}'')+\tau(\mathbf{x},\mathbf{x}'')], \text{and}$$

$$\frac{\partial G(\mathbf{x}, \mathbf{x}'', t)}{\partial s(\mathbf{x}')}$$

$$-2s(\mathbf{x}')u(\mathbf{x},\mathbf{x}')u(\mathbf{x}',\mathbf{x}'')\ddot{\delta}[t-\tau(\mathbf{x},\mathbf{x}')-\tau(\mathbf{x}',\mathbf{x}'')+\tau(\mathbf{x},\mathbf{x}'')].$$

$$\frac{\partial p(\mathbf{x}, t)}{\partial s(\mathbf{x}')}$$

$$\int \iiint \frac{\partial G(\mathbf{x}, \mathbf{x}'', t)}{\partial s(\mathbf{x}')} w(\mathbf{x}'', t - t') d\mathbf{x}'' dt'$$

$$\iiint -2s(\mathbf{x}')u(\mathbf{x},\mathbf{x}')u(\mathbf{x}',\mathbf{x}'')\ddot{w}[\mathbf{x}'',t-\tau(\mathbf{x},\mathbf{x}')-\tau(\mathbf{x}',\mathbf{x}'')+\tau(\mathbf{x},\mathbf{x}'')]d\mathbf{x}''.$$

$$w(\mathbf{x}, f) = w(f)\delta(\mathbf{x} - \mathbf{x}_0), \quad \text{then } p(\mathbf{x}, f) = G(\mathbf{x}, \mathbf{x}_0, f)w(f).$$

$$\int \frac{\partial\theta(\mathbf{x}, \mathbf{x}_0, t - t')}{\partial s(\mathbf{x}')} p(\mathbf{x}, t') dt'$$

$$-2s(\mathbf{x}')\frac{u(\mathbf{x},\mathbf{x}')u(\mathbf{x}',\mathbf{x}_0)}{u(\mathbf{x},\mathbf{x}_0)}\ddot{p}[\mathbf{x},t-\tau(\mathbf{x},\mathbf{x}')-\tau(\mathbf{x}',\mathbf{x}_0)+\tau(\mathbf{x},\mathbf{x}_0)]$$

$$-2s(\mathbf{x}')u(\mathbf{x},\mathbf{x}')u(\mathbf{x}',\mathbf{x}_0)\ddot{w}[t-\tau(\mathbf{x},\mathbf{x}')-\tau(\mathbf{x}',\mathbf{x}_0)+\tau(\mathbf{x},\mathbf{x}_0)].$$

$$\ddot{w}(t)$$

$$u(\mathbf{x}, \mathbf{x}')$$