Consider the elliptic equation

$$\alpha \frac{\partial^2 \psi}{\partial x^2} - \rho = 0. \tag{1}$$

Using the notation $\psi_i^n = \psi(t_n, x_i)$, we can do a finite difference

$$\alpha \frac{\psi_{i-1}^n - 2\psi_i^{n+1} + \psi_{i+1}^n}{\Delta x^2} = \rho_i \tag{2}$$

(the liberty we took to use ψ_i^{n+1} here is to make it an iterative process, similar to the derivation of Gauss-Seidel). Solving this for ψ_i^{n+1},

$$\psi_i^{n+1} = \psi_i^n + \frac{\psi_{i-1}^n - 2\psi_i^n + \psi_{i+1}^n}{2} - \frac{\Delta x^2}{2\alpha}\rho_i. \tag{3}$$

Now consider the related parabolic equation

$$\alpha \frac{\partial^2 \psi}{\partial x^2} - \rho = \frac{\partial \psi}{\partial t}. \tag{4}$$

Again, we finite difference

$$\alpha \frac{\psi_{i-1}^n - 2\psi_i^{n+1} + \psi_{i+1}^n}{\Delta x^2} - \rho_i = \frac{\psi_i^{n+1} - \psi_i^n}{\Delta t} \tag{5}$$

and solve for ψ_i^{n+1}

$$\psi_i^{n+1} = \psi_i^n + \alpha \Delta t \frac{\psi_{i-1}^n - 2\psi_i^n + \psi_{i+1}^n}{\Delta x^2} - \Delta t \rho_i. \tag{6}$$

The two solutions (3) and (6) are only the same if

$$\Delta t = \frac{\Delta x^2}{2\alpha}. \tag{7}$$

So, if we change the coefficient of the spatial derivative (the `ct_cxx`, etc. in `CT_MultiLevel`), we should change Δt as well.

Alternatively, (7) can be seen as related to the Courant condition for stability. Changing α in (4) changes the characteristics of the equation so the time step should be changed as well.