EFFECT OF A CHANGE IN DM ON THE SUB-BURST DRIFT

When a de-dispersion is applied to a dynamic spectrum the following correction is effected to the arrival time

$$t(\nu_1) - t(\nu_2) = a\,(\nu_1^{-2} - \nu_2^{-2}) \cdot DM$$

where $a = 4.148806\,4239$ GHz^2 cm^3 pc^{-1} ms. Let's define

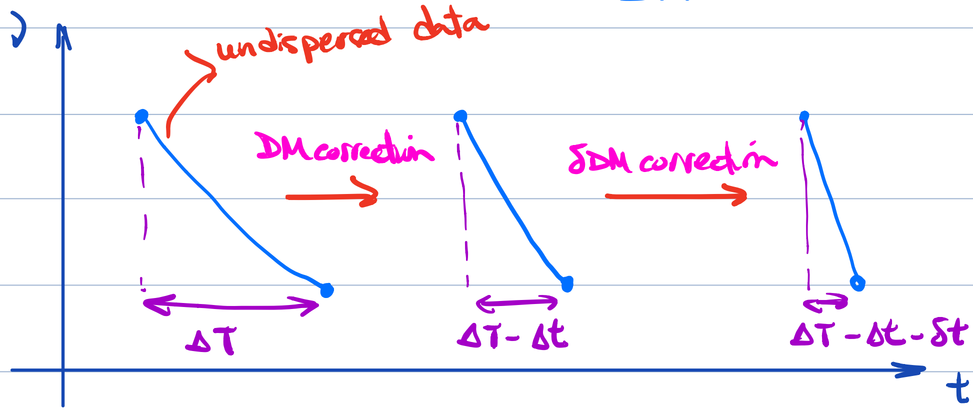
$$\Delta t \equiv t(\nu_1) - t(\nu_2)$$

& let's set $\nu_1 < \nu_2$ (i.e., $\Delta t > 0$).

We now apply a small change δDM to DM

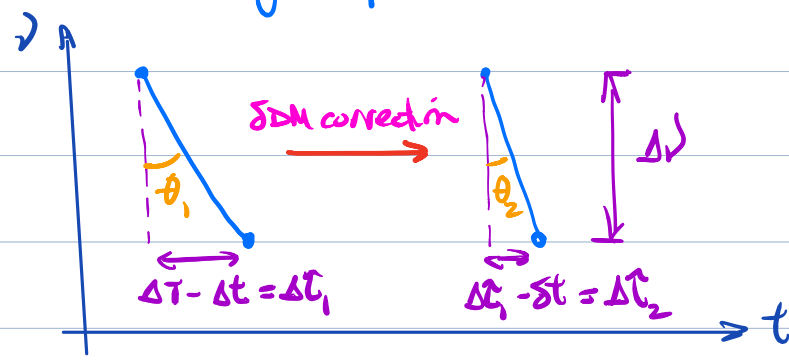
$$\Delta t + \delta t = a\,(\nu_1^{-2} - \nu_2^{-2})\,(DM + \delta DM)$$
$$= \Delta t + a\,(\nu_1^{-2} - \nu_2^{-2})\,\delta DM = \Delta t\left(1 + \frac{\delta DM}{DM}\right)$$

$$\delta t = a\,(\nu_1^{-2} - \nu_2^{-2})\,\delta DM = \Delta t\,\frac{\delta DM}{DM}$$



Here's a representation of the corrections for DM & DM+δDM

After the de-dispersion with DM the angle θ_1 is given by



$$tg\,\theta_1 = \frac{\Delta\tau_1}{t_{res}} \cdot \frac{\nu_{res}}{\Delta\nu}$$

where $\Delta\tau_1 = \Delta T - \Delta t$ (see figure above)

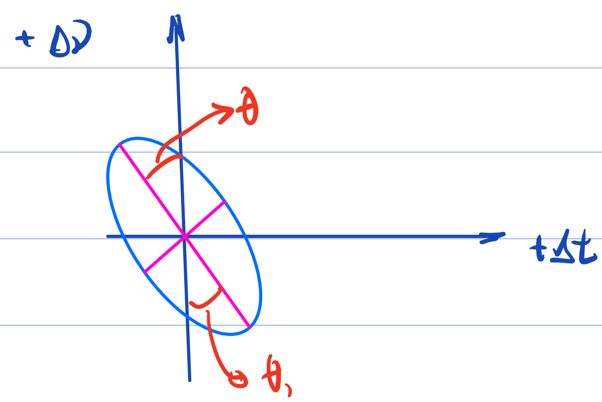
& ν_{res} & t_{res} are resolution elements in frequency & time.

Now after a "correction" by δDM we have

$$tg\,\theta_2 = \frac{\Delta\tau_2}{t_{res}} \cdot \frac{\nu_{res}}{\Delta\nu} = tg\,\theta_1 - \frac{\delta t}{t_{res}} \cdot \frac{\nu_{res}}{\Delta\nu}$$

$$\boxed{\begin{aligned}\theta_2 &= tg^{-1}\left[tg\,\theta_1 - \frac{\delta t}{t_{res}} \cdot \frac{\nu_{res}}{\Delta\nu}\right] \\ &= tg^{-1}\left[tg\,\theta_1 - \frac{\Delta t}{t_{res}} \cdot \frac{\nu_{res}}{\Delta\nu} \cdot \frac{\delta DM}{DM}\right]\end{aligned}}$$

So, θ_1 is the angle measured by the auto-correlation. More precisely, for his plots of θ vs. tw Mohammed uses the angle θ defined counterclockwise from the $+\Delta\nu$ axis.



We therefore effectively have

$$\theta = \theta_1$$

It follow that θ_2 can be evaluated from θ_1 if one can determine

$$\boxed{\delta t = a(\nu_1^{-2} - \nu_2^{-2})\,\delta DM = \Delta t \frac{\delta DM}{DM}}$$

i.e. $\Delta \nu$.