Camryn Mullin 260926298

1) For script $\chi^2 = 15264.645$. This is generally not considered to be acceptable

With the new parameters $\chi^2 = 3272.57$.

Mean $= 2561$, $\sigma = \sqrt{2(2561)}$ mean $+ A\sigma = \chi^2 \rightarrow \dfrac{\chi^2 - \text{mean}}{\sigma}$

15264.645 is ~ 180 sigma from the mean.
3272.57 is ~ 11 sigma from the mean. A clear improvement

2) Find best fit params using LM or Newton
   numerical derivatives

Newton's $A_m^T N^{-1} A_m \, dm = A_m^T N^{-1} r$

LM:

$\left[A_m^T N^{-1} A_m + \lambda \, \text{diag}() \right] dm = A^T N^{-1} r$

("step works" $\rightarrow \chi^2 \not{} \text{inc}$)

$\partial m = \left(A_m^T N^{-1} A_m \right)^{-1}$
$\underbrace{\quad}_{\text{derivative matrix}}$

do derivative for each parameter separately, pick
$dx = 0.01 x_i$ where x_i is the value of the param
you're changing

3) $\Omega_A = 1 - \Omega_b - \Omega_c$

Chain[1] $= \Omega_b h^2$ Chain[2] $= \Omega_c h^2$

$h = \dfrac{H_0}{100}$ ← (Chain[0])

$\Omega_A = 1 - \dfrac{\text{Chain}[1]}{h^2} - \dfrac{\text{Chain}[2]}{h^2}$

err: $\dfrac{\text{err}[1]}{h^2} \perp \dfrac{\text{err}[2]}{h^2}$

| Dark energy is 0.697 ± 0.008. |

The chains are not yet converged. This is likely
due to the inferiority of Newton's method as
opposed to Levenberg Marquart. However, as can be seen
from the zoomed in chisq image, chisq is approaching noise
like behavior, meaning that it is an idl way to converging.

4)

I used Levinberg Marquart with importance sampling to re-estimate the covariance matrix.

When comparing the answer to importance sampled problem3 the chsq from importance sampling prob3 is actually marginally improved and the errors are smaller.