B.E.: Same values as N_a: Gives ratio of Fe in ground to Fe in excited $Fe_1 : Fe_2$

$$\frac{N_2}{N_1} = \frac{g_2}{g_1} e^{-\frac{E_2-E_1}{kT}} = \frac{4}{2} e^{-\left(\frac{(-3.04)-(-5.14)\,eV}{8.62\times10^{-5}\frac{eV}{K}\cdot 5780K}\right)} = 0.03$$

Saha: $\frac{Fe_{II}}{Fe_{I}} = 2522.6410$ assuming N_a values

Column Density

$$D = N_1 \times \left(1+\frac{N_2}{N_1}\right)\times\left(1+\frac{Fe_{II}}{Fe_{I}}\right) = N_1\,(1.03)(2523.6410)$$

$$\log w/\lambda = \log\left(\frac{1.999Å}{4101.5Å}\right) = -3.31$$

$\log(N_1 f(\lambda/5000Å)) \approx 16$ via graph

$f = .65$
$w = 1.999Å$
$\lambda = 4101.5Å$

$$\frac{N_1 f\lambda}{5000} = 10^{16}$$

$$N_1 = 1.875\times10^{16}$$

$$D = 1.875\times10^{16}(1.03)(2523.6410) = 4.875\times10^{19} = N(Fe)$$

Galactic Astronomer Version

$$12+\log_{10}\left(\frac{N(Fe)}{N(H)}\right) = 12+\log_{10}\left(\frac{4.875\times10^{19}}{6.6\times10^{23}}\right) = 7.868$$

Physicist mole ratio version

$$N_{Fe}/N_{H} = 7.386\times10^{-5}$$

Stellar Astronomer

$$7.87-7.48 = 0.39$$