

Imports

```
In [2]: from uncertainties import ufloat
from uncertainties.umath import * # sin(), etc.
from scipy.constants import *
```

Sensitive Spins

```
In [3]: B0 = ufloat(3.53, 0.02) # in kG - from gaussmeter
y = 2.675*10**4 # gyromagnetic ratio
delE = y*hbar*B0*10**3
T=293 #K
ratio=exp(-delE/(k*T))
print(delE)
print("N2/N1= "+ str(ratio))
print("percent sensitive: "+str((1-ratio)*100))

(9.96+/-0.06)e-27
N2/N1= 0.999997538+/-0.000000014
percent sensitive: 0.0002462+/-0.0000014
```

Calculation of B0 from frequency

```
In [4]: f0 = ufloat(15.19758,.00004)#in MHz
print("B0 = "+str(f0/4.258 ))

B0 = 3.569183+/-0.000009
```

Varying Temp and Field

```
In [5]: T=10
print(100*(1-exp(-delE/(k*T))))

0.00721+/-0.00004
```

```
In [6]: T=293
delE = y*hbar*B0*10**4.5
print(100*(1-exp(-delE/(k*T))))

0.00778+/-0.00004
```

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```
In [10]: invT2=ufloat(.16053,.0143)
         invT1=ufloat(.046,.000742)
         print("T1: "+str(1/invT1))
         print("T2: "+str(1/invT2))
```

T1: 21.74+/-0.35

T2: 6.2+/-0.6

In []: