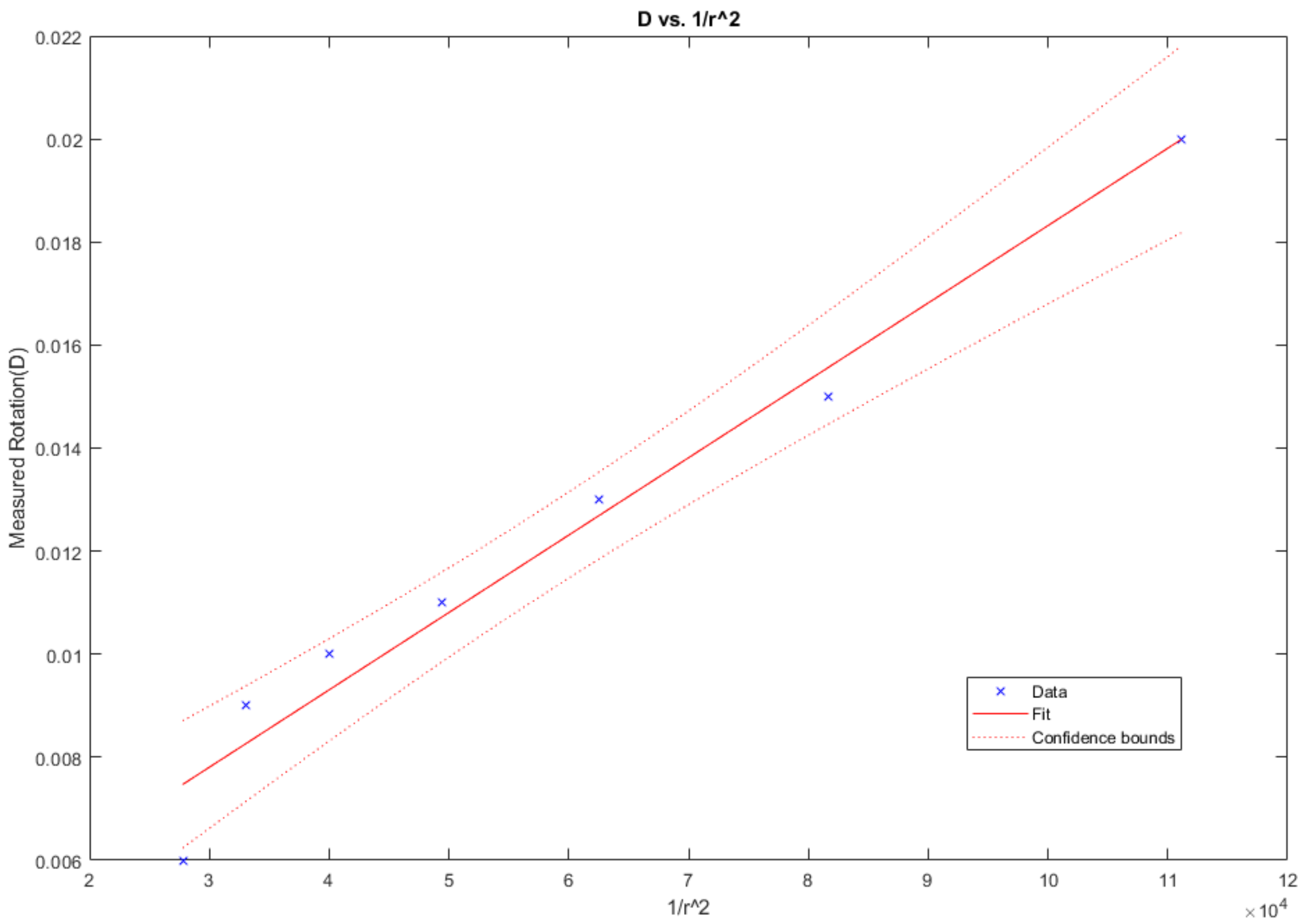
1) Here is my data table with all my calculated values. The last measurement is omitted from the regression analysis since we used it to see if our charge held throughout the experiment

	Data Set			
	dF	radius	deltaDistance	InverseRSquare
1	0.154	0.006	0.006	27777.778
2	0.151	0.0055	0.009	33057.851
3	0.15	0.005	0.010	40000.000
4	0.149	0.0045	0.011	49382.716
5	0.147	0.004	0.013	62500.000
6	0.145	0.0035	0.015	81632.653
7	0.14	0.003	0.020	1.111E+05
8	0.153	0.006	0.007	27777.778

$D_q = 160cm$

2) Here is my D vs $1/r^2$ graph. The details for the regression are under question 8.

CI = 95%



3.) When a glass rod is rubbed with a patch of rabbit fur, it gains electrons and becomes negatively charged. Silk has the opposite effect, electrons move from the rod to the silk leaving the rod positively charged

4.) We suppose that the net charge of the system is neutral.

5.) During the rubbing process electrons from the fur transfer to the styrafoam via conduction charge. By the law of conservation of electric charge the net charge stays Neutral.

6.) Applying Gauss's law we know that a sphere has an Electric field of,

$$E = \frac{Q}{4\pi\epsilon_0 r^2} \quad \text{when } r < R,\ E = 0.$$

Since we can't have the spheres overlapping gauss's law says that the spheres act like giant point charges so R stays the same.

7.) Consider equation 6,

$$D = Kq_1q_2\left(\frac{ab}{j}\right)\frac{1}{r^2}.$$

This equation is derived from the relationship between the Torsional force, F_s and the electric force F_e. So if we find that,

$$\underbrace{D \propto \frac{1}{r^2} \Rightarrow}_{\text{by Hookes law}} \underbrace{F_s \propto \frac{1}{r^2} \Rightarrow}_{F_e = F_s \text{ by expirment}} \boxed{F_e \propto \frac{1}{r^2}}$$

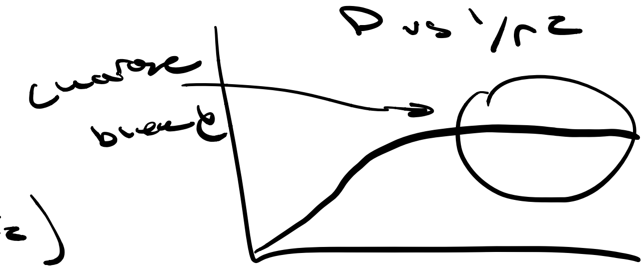
Coulombs law.

To show $D \propto \frac{1}{r^2}$ we want D vs. $\frac{1}{r^2}$ to be linear looking. So $D = k\frac{1}{r^2}$ where k is some slope.

8.) Our linear model returns a p-value for the slope variable that is on the order of 10^{-5} meaning that we reject the null hypothesis that these variables are non-proportional. With an r^2 value of .97 we know that our linear fit is very accurate.

```
>> L = fitlm(rInverse,D)

L =


Linear regression model:
    y ~ 1 + x1

Estimated Coefficients:
                    Estimate       SE         tStat      pValue  
                   __________    __________    ______    _________

    (Intercept)     0.0032998    0.00075363    4.3786     0.0071642
    x1              1.502e-07    1.1745e-08    12.788    5.2029e-05


Number of observations: 7, Error degrees of freedom: 5
Root Mean Squared Error: 0.000858
R-squared: 0.97,  Adjusted R-Squared: 0.964
F-statistic vs. constant model: 164, p-value = 5.2e-05
```

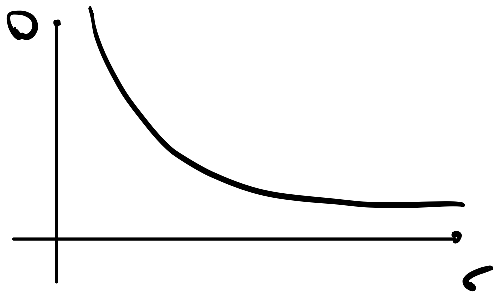
9.) Charge bleed would lead to a lesser measured rotation. This would result in a smaller slope variable.



We know from

$$D = k q_1 q_2 \left(\frac{ab}{J}\right)\left(\frac{1}{r^2}\right)$$

that as $r \to 0$ the $\frac{1}{r^2}$ term increases and as a result the D term must also increase.



Since we treat spheres as point charges the infinity buisness dont actually happen.

10.) Some examples of uncertainty are charge bleed, The accuracy of the laser systems. For some a draft in the room would continually ossillate the laser. The manufacturing tolerances of the bearings.

11) The smaller the distance the greater the electric force.