Final Paper Calculations

In [2]:
```
%pylab inline
```

```
Populating the interactive namespace from numpy and matplotlib
```

Angular Momentum

In [50]:
```
# Present state Earth-Moon L
# Data from NASA moon fact sheet https://nssdc.gsfc.nasa.gov/planetary/
M_E = 5.97e24 #kg
R_E = 6.38e6 #m
P_E = 24*60*60 #s
L_E_rot = 0.3308*M_E*(R_E**2)*((2*pi)/P_E)
print("Earth's rotational angular momentum =", L_E_rot, "kgm^2/s")

M_M = 7.35e22 #kg
a_M_orb = 3.84e8 #m
P_M_orb = 27.32*24*60*60 #s
L_M_orb = M_M*(a_M_orb**2)*((2*pi)/P_M_orb)
print("Moon's orbital angular momentum =", L_M_orb, "kgm^2/s")

G = 6.67e-11 #M^3/kgs^2
L_tot = L_E_rot + L_M_orb
L_Zahnle = 0.3308*M_E*(R_E**2)*((2*pi)/P_E) + M_M*(sqrt(G*(M_M+M_E)*a_M
print("total angular momentum =", L_tot, "kgm^2/s")
print("by Zahnle's formula, L =", L_Zahnle, "kgm^2/s")
```

```
Earth's rotational angular momentum = 5.845845259571392e+33 kgm^2/s
Moon's orbital angular momentum = 2.884929593457567e+34 kgm^2/s
total angular momentum = 3.469514119414706e+34 kgm^2/s
by Zahnle's formula, L = 3.476330445592542e+34 kgm^2/s
```

In [51]:
```
# Future state Earth-Moon L
# Predicted future state data from Na (2012)
omega_M = 2e-6 #rad/s
a_M_orb_future = 4.8e8 #m
L_M_orb_future = M_M*(a_M_orb_future**2)*omega_M
print("Moon's future orbital angular momentum =", L_M_orb_future, "kgm^

L_E_rot_future = L_Zahnle-L_M_orb_future
print("Earth's future rotational angular momentum =", L_E_rot_future, "

P_E_future = (0.3308*M_E*(R_E**2)*2*pi)/L_E_rot_future
print("Earth's future rotational period =", P_E_future/(60*60), "hours"
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```

```
Moon's future orbital angular momentum = 3.3868799999999998e+34 kgm^2/s
Earth's future rotational angular momentum = 8.945044559254204e+32 kgm^2/
s
Earth's future rotational period = 156.84693944264825 hours
```

Out[51]:
```
6.541666666666667
```