6.2: Gravity

The theory of gravity can be looked at in two ways: The old fashioned Newtonian gravity, where the potential is proportional to the rest mass of the particles,

$$V = \frac{G_N m_1 m_2}{r}.$$

We find that $G_N m_p^2/\hbar c$ is dimensionless, and takes on the value

$$G_N m_p^2/\hbar c = 5.9046486 \times 10^{-39}.$$

There are two more levels to look at gravity.

- One of those is Einstein's theory of gravity, which in the low-energy small-mass limit reduces to Newton's theory. This is still a *classical* theory, of a classical gravitational field.
- The quantum theory, where we re-express the field in their quanta has proven to be a very tough stumbling block – When one tries to generalize the approach taken for QED, every expression is infinite, and one needs to define an infinite number of different infinite constants. This is not deemed to be acceptable – i.e., it doesn't define a theory. Such a model is called *unrenormalizable*. We may return to the problem of quantum gravity later, time permitting.