

### Problem 2.1

Calculate the ratio of the gravitational attraction to the electrical repulsion between two stationary electrons. (Do I need to tell you how far apart they are?)

solution

$$F_g = \frac{Gm_e^2}{r^2}$$

$$F_e = \frac{kq_e^2}{r^2}$$

$$F_g/F_e = \frac{Gm_e^2}{kq_e^2}$$

$$G = 6.67 \times 10^{-11} m^3 \cdot kg^{-1} \cdot s^{-2}, m_e = 9.1 \times 10^{-31} kg, \\ k = 8.98 \times 10^9 N \cdot m^2 \cdot C^{-2}, q_e = 1.6 \times 10^{-19} C$$

$$F_g/F_e = 2.4 \times 10^{-43}$$

No, the distance squares are canceled out.

### Problem 2.2

Sketch the lowest-order Feynman diagram representing Delbruck scattering:  $\gamma + \gamma \rightarrow \gamma + \gamma$ . (This process, the scattering of light by light, has no analog in classical electrodynamics.)

Solution

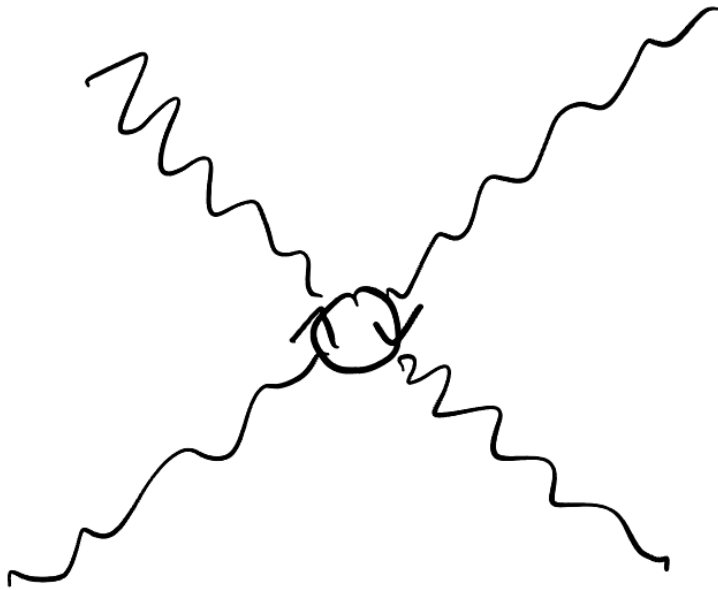


Figure 1: The lowest photon scattering (not sure)