

**Divergences and dimensional regularization**

**Exercise 1:** Show that the propagator

$$G_E(x-y) \equiv \int \frac{d^4 P}{(2\pi)^4} \frac{e^{iP \cdot (x-y)}}{P^2 + m^2}$$

is finite for  $x \neq y$ . How does it behave for  $|x-y| \rightarrow \infty$ ?

**Exercise 2:**

(a) Determine the integral

$$I(m^2; d, A) \equiv \int \frac{d^d P}{(2\pi)^d} \frac{1}{(P^2 + m^2)^A}$$

in dimensional regularization.

(b) Work out the expansion of  $I(m^2; 4 - 2\epsilon, 1)$  for  $\epsilon \ll 1$  up to order  $\epsilon^0$ .