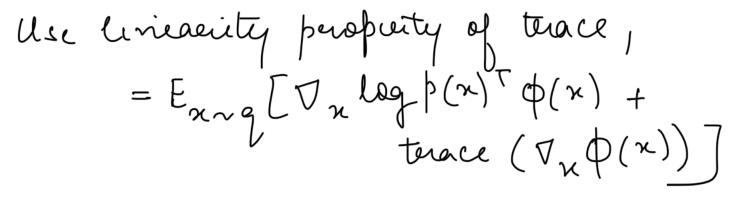
Section -4.1 Paerticle - Based Updette Rule I The optiminan objectuée  $D(q, \beta) = \max_{\phi \in H^d} E_{\pi \sim q} \left[ \text{teace} \left( A_{\beta} \phi(\pi) \right) \right]$ 11411 Hy < 1 We have to find the oftenal direct of in RKHS that gives maximum discent of KL dueungence. (I) Use the Stein Operation  $A_p \phi(x) = \nabla_x \log_p(x) \cdot \phi(x)^T + \nabla_x \phi(x)$ We have to find, Ex~q[terace(A,p(x))] We can eneuerite this as Exag[terace (App(x))] = En-q [terace (Vn log p(x). p(x)+ Vn p(x))



(III) RKHS Ball Optimingan Manimine the vinear peroduct in RKHS, < 0, 0 9, p > 1, 8  $\phi^*q$  = aeg. max  $E_{\chi \chi q}$  [teace (  $A_{\rho}$   $\phi(\chi)$ )] = 7, KL[9[b]||b]) /= 0 This means that of turnal directions is basically the geradient of KL dueingence in RKHS. We can also show it using the kennel trick.

I RKHS FORM

In RICHS, erepresent any eq d(n) EHd as

$$\phi(x) = \sum_{i=1}^{n} a_{i}k(x_{i}, x)$$
Reveriting functional gradient of klas,
$$\phi^{\dagger}_{q,p}(x) = E_{x'} \sim_{q} [A_{p} k(x', x)]$$
Hene, we apply the stein operator to the kennel func",  $k(x', x)$ .

(I) Apply Stein Operator to Reenel
$$Apply A_{p} \text{ to } k(x', x)$$

$$A_{p} k(x', x) = \nabla_{x'} \log_{p}(x') \cdot k(x', x) + \nabla_{x'} k(x', x)$$

$$Take expects a own x' \sim_{q} \int_{q',p'} (x) = E_{x'} \sim_{q} [\nabla_{x'} \log_{p}(x') \cdot k(x', x) + \nabla_{x'} k(x', x)]$$

> This is eq 6. It helps to update balances atterach to the posterior & dieersity across particles.