We note that the function r^{-s} is locally integrable for $s < n$ but not for $s = n$.

┌ By P136, Rudin's F.A., a complex function f is said to be locally integrable if f is meaourable and $\int_K |f| < \infty$ for every compact $K \subset R$.

Given a compact $K \subset \mathbb{R}^n$, $\exists$ a ball $B(0, l)$ s.t $B(0, l) \supset K$.

$$\int_{B(0,l)} r^{-s}\, dx_1 \wedge \cdots \wedge dx_n = \lim_{n\to\infty} \sum_{k=1}^{n} r_k^{-s} \Delta r \text{ (Volume of}$$

the sphere with radius r_k) $= \int_0^l r^{-s}\, C_n\, r^{n-1}\, dr$

Since the volume of the sphere with radius r_k $= C_n r_k^{n-1}$, for example, $n = 2$, $2\pi r_k$, $n = 3$, $4\pi r_k^2$.

$\Rightarrow$ $C_n \int_0^l r^{-s} r^{n-1}\, dr = C_n \int_0^l r^{n-s-1}\, dr < \infty$ if $n - s - 1 \geq 0$, otherwise ∞.

$\Rightarrow$ If $s \leq n-1$, i.e. $s < n$, then r^{-s} is locally integrable and if $s = n$, r^{-s} is not locally integrable. ┘

Define

$$\sigma = C_n \frac{\sum \Phi_i(x)}{\|x\|^n}$$

$$= C_n \frac{*r\,dr}{r^n}.$$

┌ Recall. $r\,dr \wedge *r\,dr = \langle r\,dr, r\,dr \rangle\, dx_1 \wedge \cdots \wedge dx_n$

$= \langle \sum x_i\, dx_i, \sum x_i\, dx_i \rangle\, dx_1 \wedge \cdots \wedge dx_n$ by P82.

$= \sum x_i^2\, dx_1 \wedge \cdots \wedge dx_n = r^2\, dx_1 \wedge \cdots \wedge dx_n$.

$r\,dr \wedge \sum \Phi_i(x) = \sum x_i\, dx_i \wedge \sum (-1)^{i-1} x_i\, dx_1 \wedge \cdots \wedge \widehat{dx_i} \wedge \cdots \wedge dx_n$