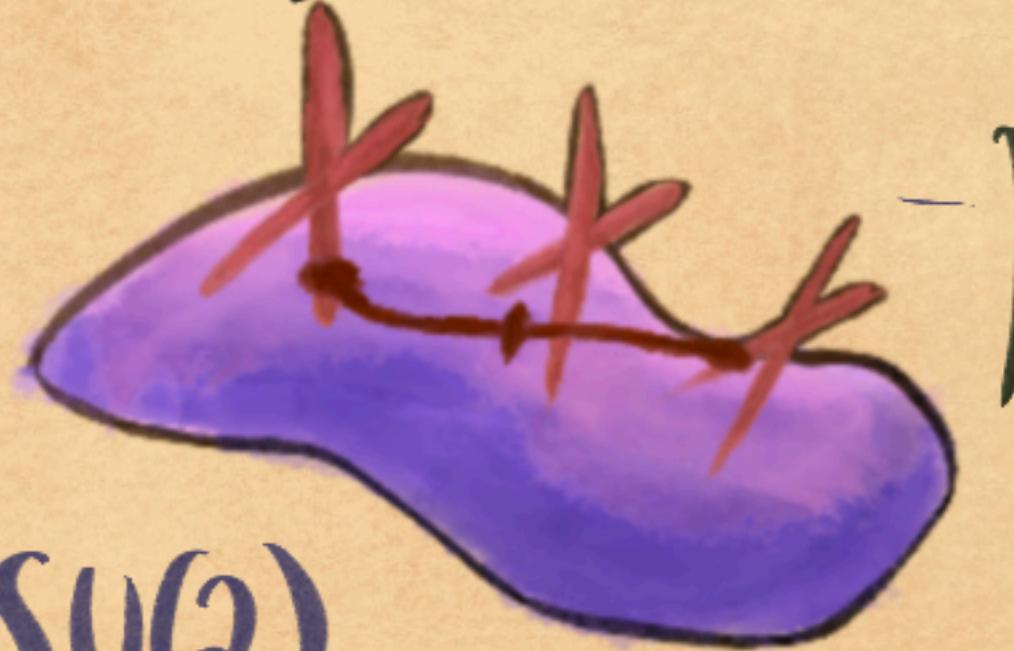
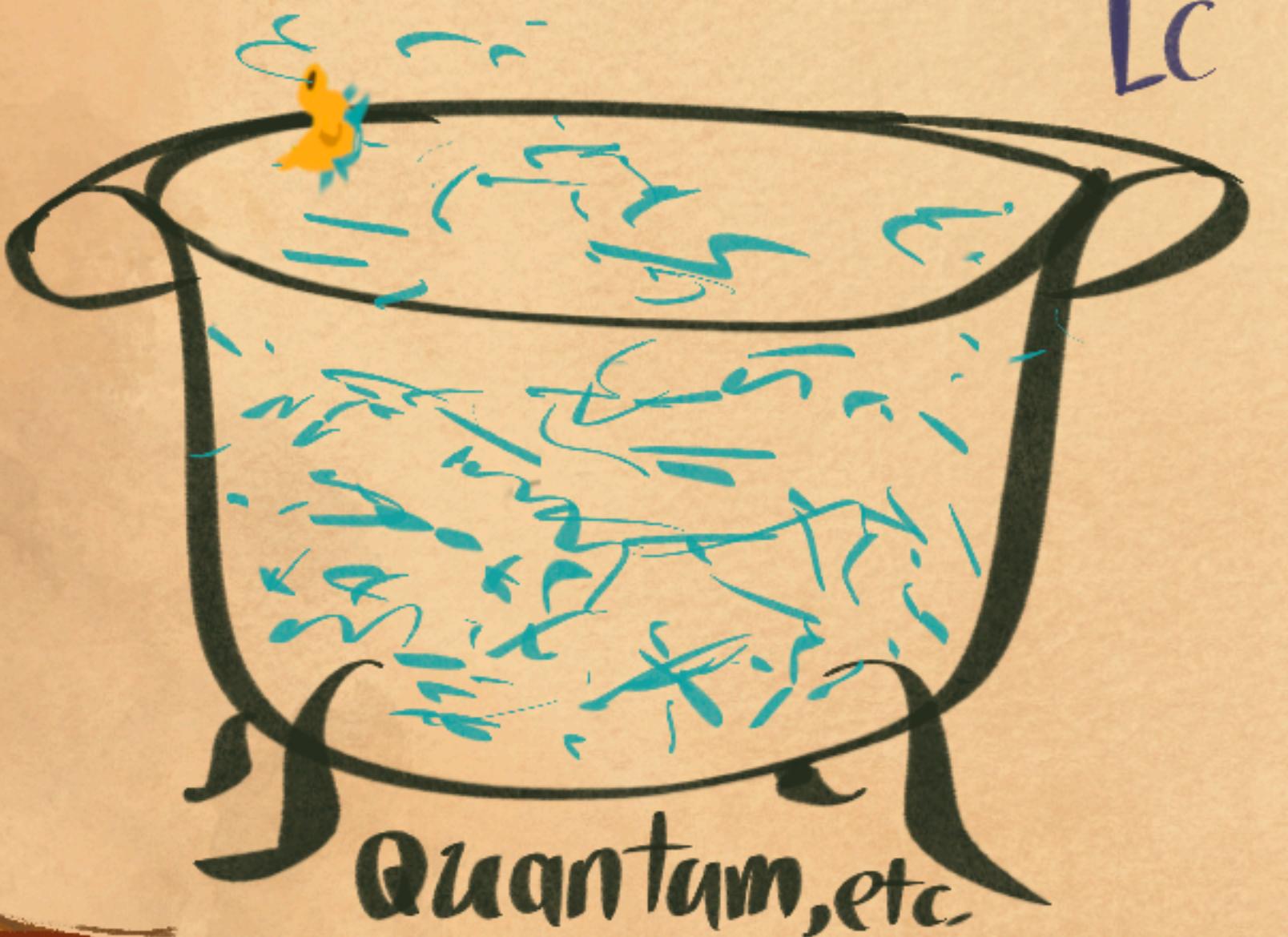


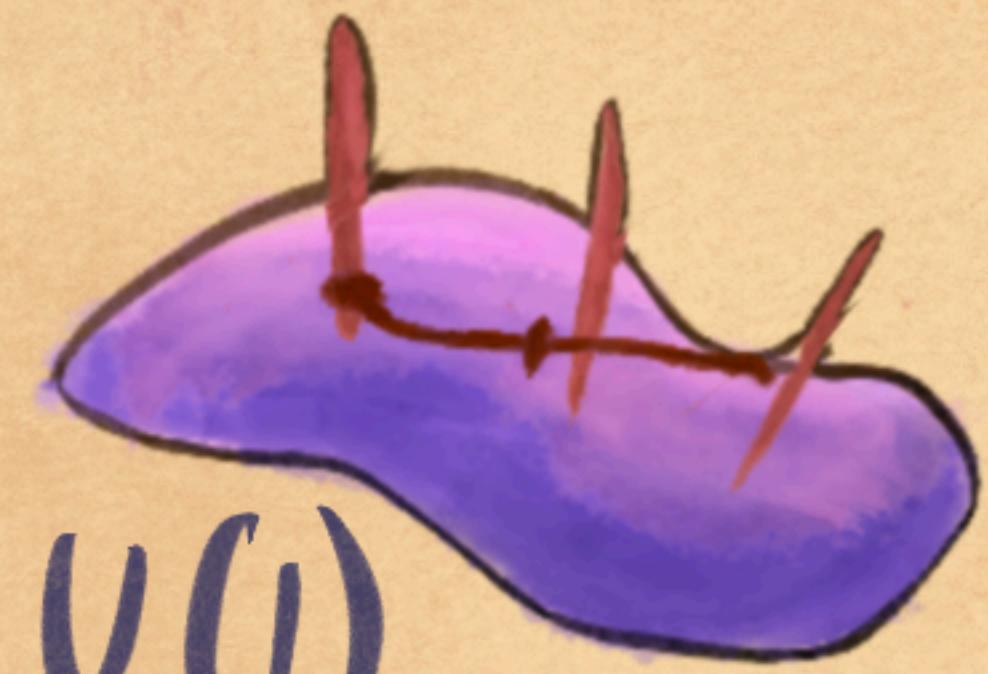
High Energy
complicated



$SU(2)$



Low Energy
simple (r)

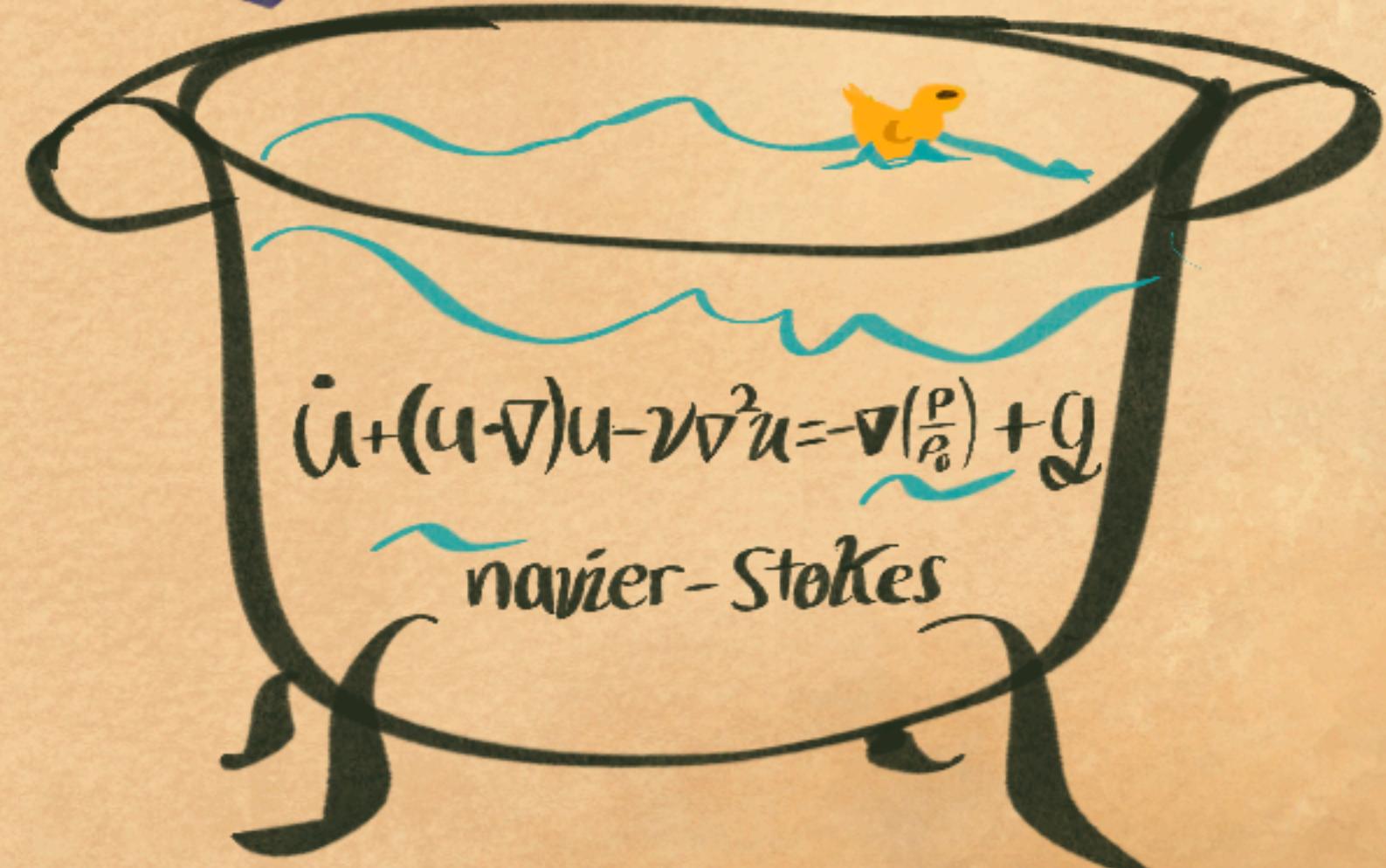


$U(1)$

Renormalization

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

$$\begin{bmatrix} e^{i\theta} \\ e^{-i\theta} \end{bmatrix}$$



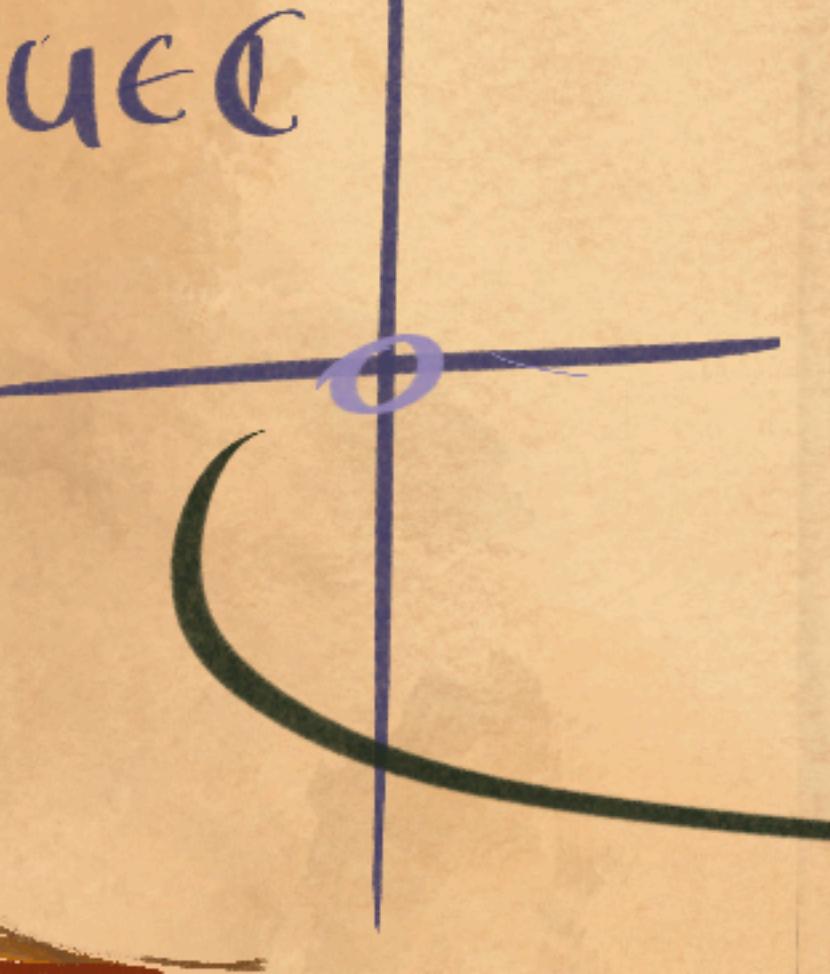
Result of renormalization:

$\|dA\|^2$ topological
U(1) gauge theory: $\mathcal{L} = \frac{1}{g(u)^2} S dA \wedge *dA + \Theta(u) S dA \wedge A + \dots$
1-form A

combine into $\chi(u) = \Theta(u) + \frac{i}{g^2(u)}$ "electric"
"magnetic"

strengths $g(u), \Theta(u)$ depend on a parameter

"space of vacua" columb branch
possible zero-energy configurations
(i.e zero curvature, etc)



$$\tau \in \{C \mid \text{Im } \tau > 0\}$$

$$\text{Symmetries: } \tau \mapsto \tau + 1$$

$$\tau \mapsto -\frac{1}{\tau} \quad \text{electric-Magnetic}$$

$$(\theta=0 \Rightarrow g \mapsto 1/g) \quad \text{duality}$$

