The S-Matrix of Partially Broken Supersymmetry

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Based on work with: **Henriette Elvang**, **Marios Hadjiantonis** & **Shruti Paranjape**

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- Present in many Goldstone EFTs as an *emergent* IR symmetry

$$S = \underbrace{\sum_{[\mathcal{O}_i] \leq \Delta} \int \mathsf{d}^4 x \ g_i \mathcal{O}_i(x)}_{\text{Universal}} + \underbrace{\sum_{[\mathcal{O}_i] > \Delta} \int \mathsf{d}^4 x \ g_i \mathcal{O}_i(x)}_{\text{Non-Universal}}.$$

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- *How do we construct the S-matrix?*
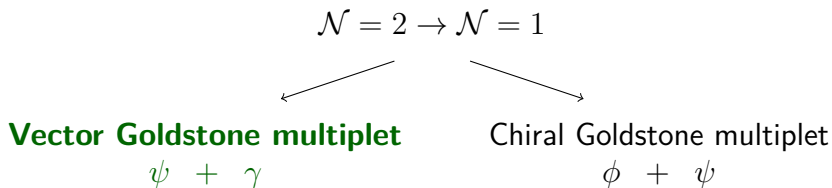 ⇒ **Subtracted Recrusion**:
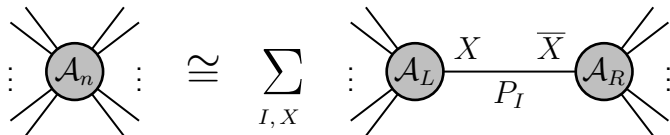
Partially Broken Supersymmetry
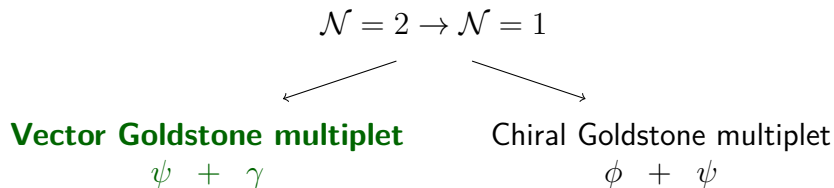
- **Simplest Example:**

$$\mathcal{N} = 2 \to \mathcal{N} = 1$$

Vector Goldstone multiplet
$$\psi \ + \ \gamma$$

Chiral Goldstone multiplet
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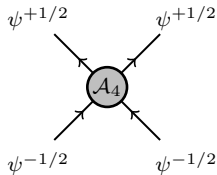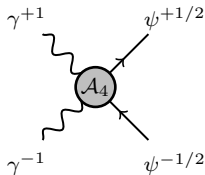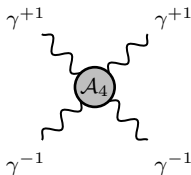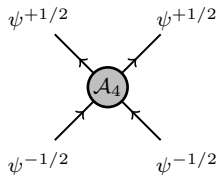
Vector Goldstone multiplet
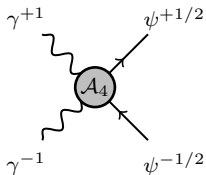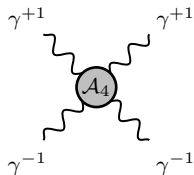$$\psi \;+\; \gamma$$

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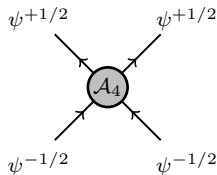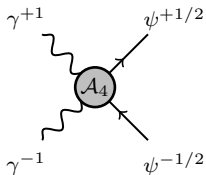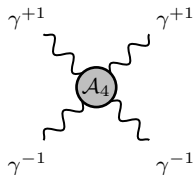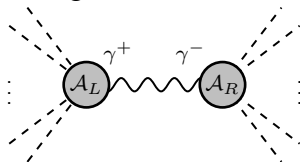- Subtracted recursion valid at **leading order** $\mathcal{A}_4 \sim \mathcal{O}\left(\Lambda^{-4}\right)$:

Recursion Implies Conservation

- Fundamental interactions seperately conserve:
  - Bosonic helicity: $n_\gamma^+ - n_\gamma^-$
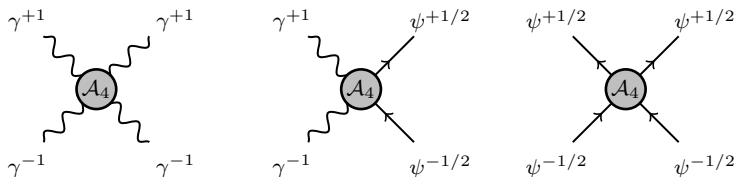 - Fermionic helicity: $n_\psi^+ - n_\psi^-$

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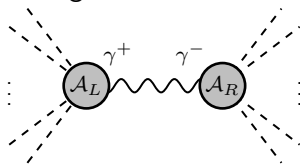 - Fermionic helicity: $n_\psi^+ - n_\psi^-$
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- **Universality:** Any model with $\mathcal{N} = 2 \to \mathcal{N} = 1$ spontaneous supersymmetry breaking must have both an emergent *fermionic chiral symmetry* and an emergent *electromagnetic duality* at very low energies

Thank you!