Mathematical foundations of non-Hermitian quantum field theory

Esra Sablevice

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Poincaré symmetries and representations in pseudo-Hermitian quantum field theory

Esra Sablevice* and Peter Millington†

Department of Physics and Astronomy, University of Manchester, Manchester M13 9PL, United Kingdom

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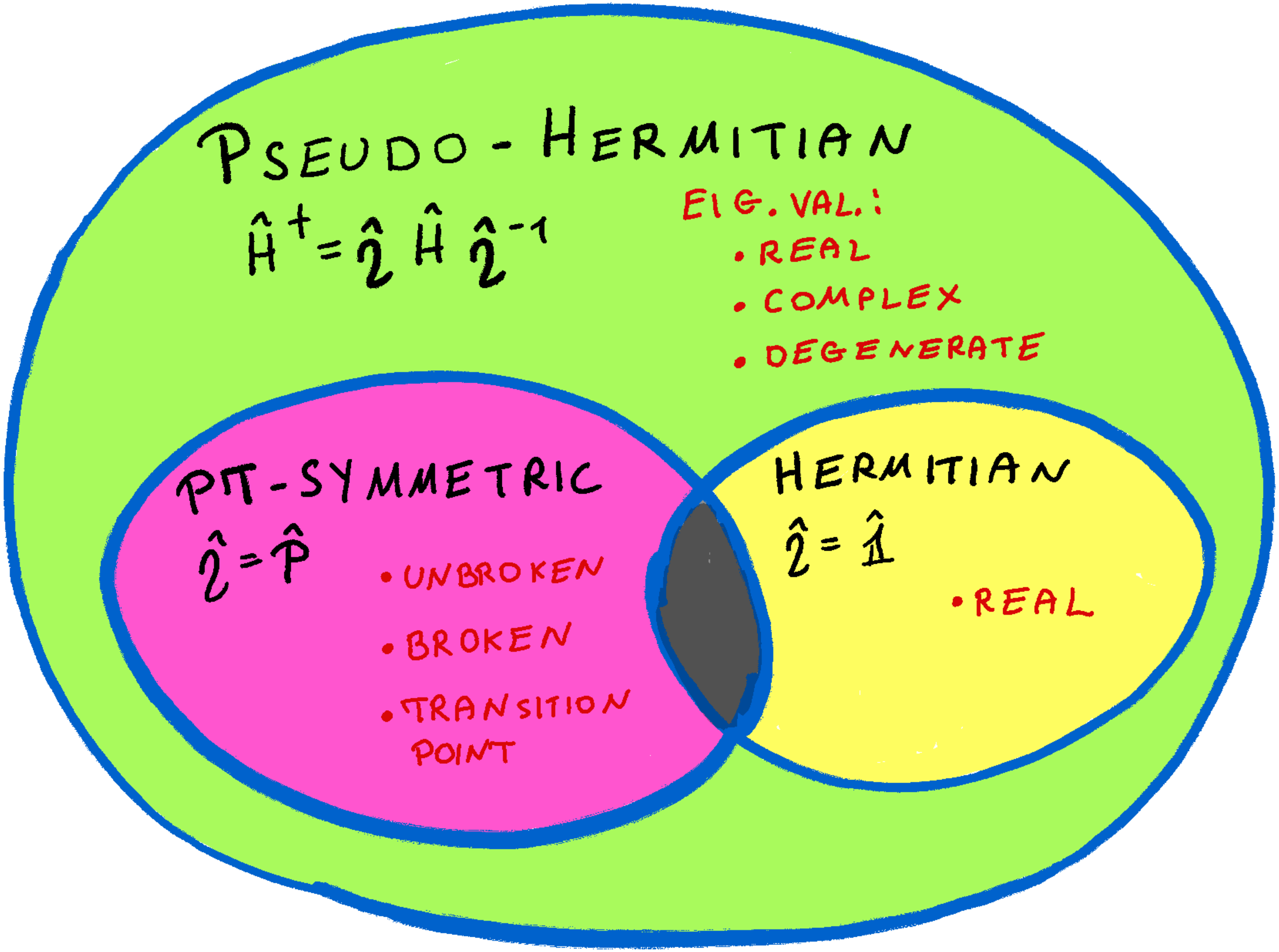

PSEUDO-HERMITIAN
$\hat{H}^{+} = \hat{\eta}\hat{H}\hat{\eta}^{-1}$
EIG. VAL.:
• REAL
• COMPLEX
• DEGENERATE
PT-SYMMETRIC
$\hat{\eta} = \hat{P}$
• UNBROKEN
• BROKEN
• TRANSITION POINT
HERMITIAN
$\hat{\eta} = \hat{1}$
• REAL

HAMILTONS EQUATIONS:

$$\boxed{\begin{aligned} [\hat{\psi}(x), \hat{H}] &= i\partial_0 \hat{\psi}(x) \\ [\hat{\psi}^\dagger(x), \hat{H}^\dagger] &= i\partial_0 \hat{\psi}^\dagger(x) \end{aligned}}$$

$$\hat{H}^\dagger \neq \hat{H}$$

SPACETIME TRANSLATIONS

$\hat{P}^0 = \hat{H}$, $\hat{P}^i$

$$[\hat{\psi}(x), \hat{P}^\mu] = i\partial_\mu \hat{\psi}(x)$$

ROTATIONS + BOOSTS

$\hat{J}^{ij}$ $\hat{J}^{0i}$

$$[\hat{\psi}(x), \hat{J}^{\mu\nu}] = (M^{\mu\nu} + i m^{\mu\nu})\hat{\psi}(x)$$

FOCK SPACE MATRIX COORDINATE

POINCARÉ ALGEBRA

$$[\hat{H}, \hat{J}^{0j}] = i\hat{P}^{j} \rightarrow [\hat{H}^{\dagger}, \hat{J}^{0j\dagger}] = i\hat{P}^{j\dagger}$$

$$\hat{H}^{\dagger} \neq \hat{H}$$

$\Longrightarrow$ $\hat{P}^{i}, \hat{J}^{ij}, \hat{J}^{0i}$ NOT HERMITIAN

$$\Longrightarrow \quad [\hat{\phi}^{\dagger}(x), \underline{\underline{\hat{P}^{\mu\dagger}}}] = i\partial_{\mu}\hat{\phi}^{\dagger}(x)$$

$$[\hat{\phi}^{\dagger}(x), \underline{\underline{\hat{J}^{\mu\nu\dagger}}}] = (\underline{\underline{M^{\mu\nu\dagger}}} + i m^{\mu\nu})\hat{\phi}^{\dagger}(x)$$

'DUAL' FIELD

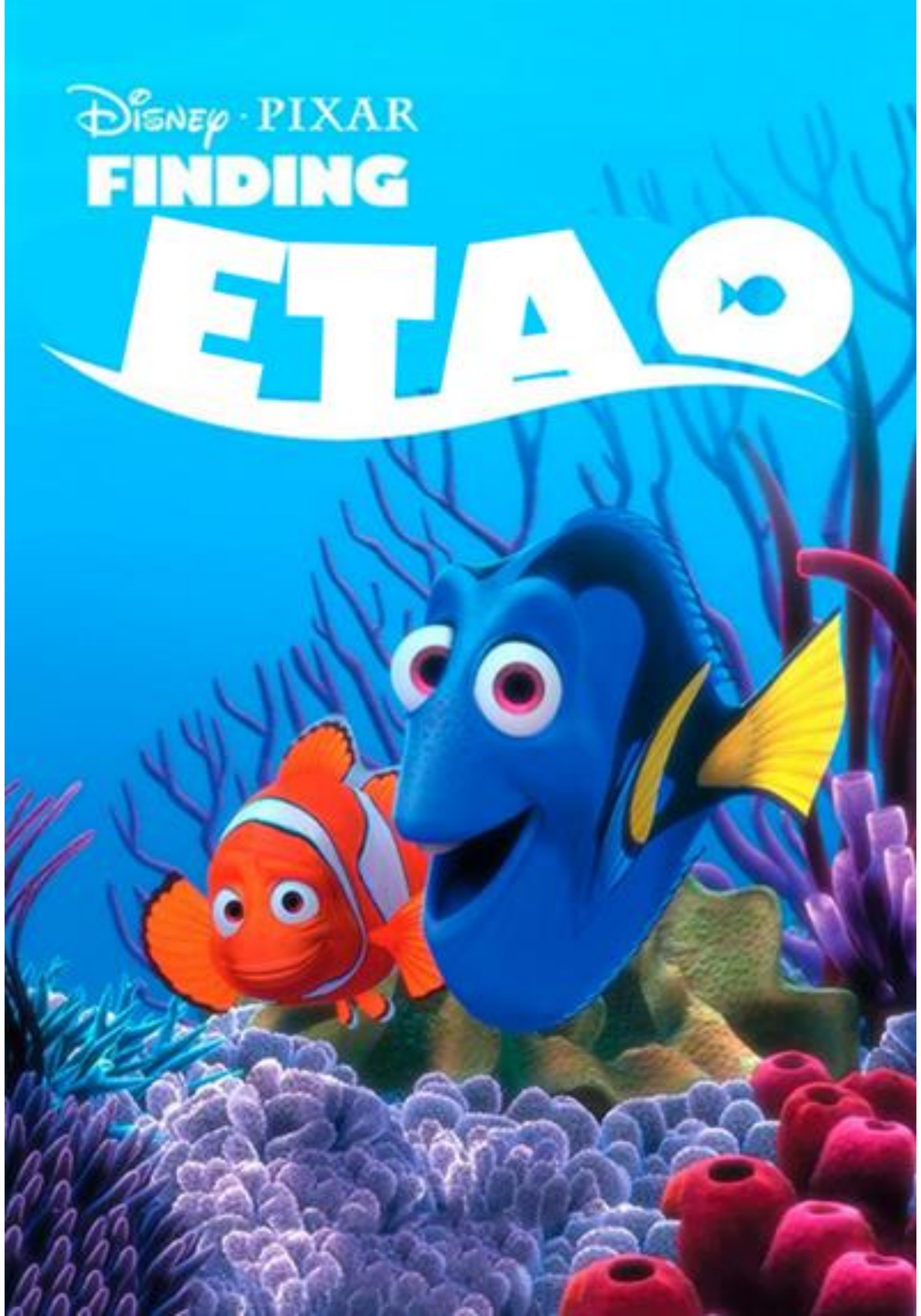
$M^{\mu\nu\dagger} = \pi M^{\mu\nu} \pi^{-1}$

$$\boxed{\hat{\tilde{\psi}}^{\dagger}(x) := \hat{\eta}^{-1} \psi^{\dagger}(x^2)\, \hat{\eta}\, \pi}$$

$\hat{H}^{\dagger} = \hat{\eta} \hat{H} \hat{\eta}^{-1}$

- $P\Pi$- SYMMETRIC

$\hat{\eta} = \hat{P}, \ \pi = P$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Thank You!