

# Joinings of $W^*$ - and $C^*$ -dynamical systems

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We study the notion of a joining of two  $W^*$ -dynamical systems, generalizing ideas from measure theoretic ergodic theory. In particular we consider necessary and sufficient conditions for ergodicity and weak mixing in terms of joinings.

Joinings of an arbitrary collection of  $C^*$ -dynamical systems are defined in terms of free products of  $C^*$ -algebras, as an analogue of joinings of classical dynamical systems. We show how multi-time correlation functions appearing in quantum statistical mechanics naturally fit into this joining framework.