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Entanglement in indistinguishable particle systems

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For distinguishable particles, there exists an agreed upon notion of entanglement based on the possibility of addressing individually each particle. Instead, the indistinguishability hinders their individual addressability and has prompted diverse, discordant definitions of entanglement. I will present a formulatiom of emtamglement in terms of correlation functions, that provides a general setting to discuss non-local effects. I will focus on the following general criteria: i) entanglement corresponds to non-local correlations; ii) when, by "freezing" suitable degrees of freedom, identical particles can be effectively distinguished, entanglement must reduce to the standard notion; iii) entanglement is a resource for quantum information protocols. These requests are satisfied by the so-called mode-entanglement theory which accounts for correlations between physical modes rather than particles.

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