The asymmetry properties of pure quantum states IMAN MAR-
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ical Physics, Waterloo, Canada — The *asymmetry properties* of a state relative to
some symmetry group specify how and to what extent the given symmetry is broken
by the state. Characterizing these is found to be surprisingly useful for address-
ing a very common problem: to determine what follows from a system's dynamics
(possibly open) having that symmetry. We demonstrate and exploit the fact that
the asymmetry properties of a state can be understood in terms of information-
theoretic concepts. We show that for a pure state ψ and a symmetry group G,
they are completely specified by the characteristic function of the state, defined
as $\chi_\psi(g) \equiv \langle\psi|U(g)|\psi\rangle$ where $g \in G$ and U is the unitary representation of in-
terest. Based on this observation, we study several important problems about the
interconversion of pure states under symmetric dynamics such as determining the
conditions for reversible transformations, deterministic irreversible transformations
and asymptotic transformations.

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