A derivation of quantum theory from physical requirements
MARKUS MUELLER, Perimeter Institute for Theoretical Physics, Waterloo (ON),
Canada, LLUIS MASANES, ICFO-Institut de Ciencies Fotoniques, Barcelona, Spain
— Quantum theory is usually formulated by postulating the mathematical structure
and representation of states, transformations, and measurements. The general phys-
ical consequences that follow (like violation of Bell-type inequalities, the possibility
of performing state tomography with local measurements, or factorization of inte-
gers in polynomial time) come as theorems which use the postulates as premises.
In this work, this procedure is reversed: we impose five simple physical require-
ments, and this suffices to single out quantum theory and derive its mathematical
formalism uniquely. This is more similar to the usual formulation of special rel-
ativity, where two simple physical requirements —the principles of relativity and
light speed invariance— are used to derive the mathematical structure of Minkowski
space-time and its transformations.