Tensor network states for quantum foundations JACOB BIA-
MONTE, CQT Singapore, ISI Foundation Torino — Penrose developed a graphical
language to reason about networks of connected tensors and applied these techniques
to quantum theory. Here we present the development of a framework and tool set
based on Penrose tensor networks that enables one to address certain questions of
a foundational nature in quantum theory. A quantum tensor theory is one in which
a fixed collection of tensors with clearly defined composition laws defines a physical
theory. We show that each element of a universal collection of such tensors gives
rise to a physical operation, allowed by the rules of quantum mechanics. Although
each of these (possibly) atemporal operations is indeed physical, certain sequences
of them could represent processes that violate the rules of quantum theory. The
question is to determine when this is the case and we arrive at some perplexing
conclusions.

Jacob Biamonte
CQT Singapore, ISI Foundation Torino