What is the Use of Tomography?

Robin BLUME-KOHOUT
Perimeter Institute for Theoretical Physics
31 Caroline St. N.
Waterloo, Ontario N2L 2Y5
CANADA

robin@blumekohout.com

Abstract

If you had infinitely many systems, prepared identically, then by making a variety of measurements on them, you could uniquely identify their quantum state. This is "tomography", and it's an increasingly important experimental tool – but performed on *finite* ensembles. With finite data, you can't identify the state perfectly – and it's not clear what the best estimate is! In this talk, I'll attempt to clarify the situation by asking, "What operational tasks actually require full-on tomography?" The answer is "surprisingly few," but I'll argue that Schumacher compression is a canonical task that *requires* full state estimation – and therefore provides an operational foundation for state estimation.