Work extraction from unknown quantum sources

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Ergotropy is one of the promising definitions of work extracted from a quantum system. Like other definitions, this definition requires full knowledge of the quantum state of the system. However, in real world the only way how to obtain this knowledge either requires creating the state, which costs at least as much as how much can be extracted, or performing a full quantum state tomography on the source, which may be impractical or even fundamentally impossible. In a real world situation, however, one would expect to do just a few measurements on an unknown source, and see how much work can be extracted by having this limited information. We do exactly that: we define a scenario in which we have a completely unknown source, characterize it by a single type of measurement, and then determine how much work can be extracted: this is done by modifying the definition of ergotropy so it applies for this situation. This models real life scenarios and goes much further into practical usefulness of ergotropy as a realistic figure of merit. Interestingly, we find that this notion of ergotropy naturally connects with recently developed notion of Observational entropy.