Speed limits on and shortcuts to reversible computing

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Mitigating computational errors

What is the problem:

- All computations suffer from errors
- Non-equilibrium and irreversible "excitations"

What are the tools:

- Classical and quantum error correcting codes
- Shortcuts to adiabaticity and thermodynamic control

Possible research agenda:

- Characterize and classify errors in reversible computing
- Adapt quantum and thermodynamic control methods
Cost of optimal control

What is the problem:

- “Information is physical” – Landauer’s principle
- Any form of error correction at expense of additional work

What are the tools:

- (Stochastic) thermodynamics of information
- Thermodynamic cost(s) of optimal control strategies

Possible research agenda:

- Develop “thermodynamics of reversible classical computing”
- Quantify resources for complete run – including error correction
Speed limits – trade-off between cost and speed

What is the problem:
- Quasistatic and reversible closely related
- Fast processes limited by fundamental physics

What are the tools:
- Classical and quantum speed limits
- Trade-off relations between QSL and cost in STA

Possible research agenda:
- Elucidate analogies of quantum adiabatic & classical reversible
- Adapt CSL and optimal control for reversible computing
Where do we go from here?

Let's have a chat....