

# Joint CS/ Physics COLLOQUIUM



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## Recent developments on the physical limits of inference

### Abstract

In this talk I first review the fact that all physical devices that perform observation, prediction, or recollection share an underlying mathematical structure. Devices with that structure are called “inference devices”.

I then present new existence and impossibility results concerning inference devices. These results have close connections with the mathematics of Turing Machines (TM's). One can define an analog of Universal TM's (UTM's) for inference devices, called “strong inference devices”. Strong inference devices can be used to define the “inference complexity” of an inference task, which is the analog of the Kolmogorov complexity of computing a string. I present some new results bounding inference complexity.

Next I present some new graph-theoretic properties that govern any set of multiple inference devices. After this I present an extension of the framework to address physical devices that are used for control. I end with an extension of the framework to address probabilistic inference.

3-4 p.m., Friday, April 18<sup>th</sup>

McLane Hall 162

Open to All