INTRODUCTION

- Hard drives record data in magnetization patterns in a thin film.
- Magnetization is related to the orientation of the electron spins within the material.

These spins are thermally agitated and therefore contribute to the overall magnetic noise in the films magnetization.
- Current hard drives write patterns in the disk with magnetization perpendicular to the plane.

One way to measure the magnetization of the sample is by the Extraordinary Hall Effect (EHE).
- The EHE is a phenomenon which creates a voltage perpendicular to the current.

HYPOTHESIS

- The magnetic noise that was previously seen when switching the sample’s magnetization is, in fact, not magnetic noise but is a remnant of the magnetic after effect due to its logarithmic time dependence.

METHOD

- An etched Co/Pd multilayer thin film (as shown below) allowed the EHE voltage to be measured.

The sample was inserted between the faces of an electro-magnet.
- By sweeping the applied field a hysteresis loop was measured to determine the coercive fields (showed below).
- The applied field was cycled between points labeled 1 - 4.
- The perpendicular magnetization of the sample was observed by these field sweeps and the time dependence of the magnetic after effect measured at several fields during the switching.

RESULTS

- The drift through the cycle can be removed in the data analysis (described later).
- An average was taken for the cycles, and the decay rates at points 2 and 4 was analyzed.

- Subtracting decay rate 4 from 2 and dividing by 2, eliminates the drift to give a time relationship described by a log(time) plot (an approximate log dependence is expected).

DISCUSSION

- These results show that the magnetic after effect behaves logarithmically in time.
- This helps in understanding the sources of magnetic noise.
- Understanding magnetic noise helps to further increase the stability of hard drive bits and therefore memory storage.

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