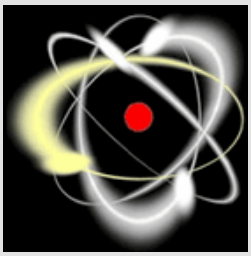
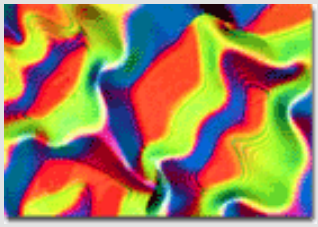


The electrons rotate on their own axis and travel in an orbit around the atom's nucleus, much as the earth spins on its own axis and travels in an orbit around the sun.



Magnetic thin films, just a few atomic layers thick, are needed for both the storage media and the recording heads of all popular recording devices.

Fast Facts

- The $40 billion recording industry relies on state- of-the-art magnetic materials.
- About one-fifth of all elements are magnetic, and there are thousands of magnetic alloys and compounds.

Hard Drives

Introduction

Audio tapes and computer hard drives are used by many Americans almost every single day. However, do you know how they work? It turns out that both audio tapes and computer hard drives are magnetic media, meaning that they use magnetic materials to record and store information. Although magnetism was discovered more than 2,600 years ago, scientists have only begun to understand the phenomenon during the last 70 years. Today, research in magnetic materials is crucial for developing state-of-the-art magnetic recording devices for the $40 billion recording industry. Magnetic thin films, just a few atomic layers thick, are needed for both the storage media and the recording heads of all popular recording devices, including tape recorders and computers. For example, a hard drive is a secondary drive that stores your information on the computer even when the computer is turned off. Information is stored in random access memory (RAM). This information is stored as magnetized regions of the media called magnetic domains.

How does magnetism work?

On an atomic scale, a material's magnetism is attributed to the orbital motions and spins of electrons in its atoms. The nucleus of an atom is surrounded by electrons that both (1) rotate on their own axis, and (2) travel in an orbit around the nucleus, much as the earth spins on its own axis and travels in an orbit around the sun. A material's magnetic moment is the sum total of all its electrons' orbital motions and spins.

How is synchrotron light used at the NSLS to study magnetic media?

Certain properties of magnetic materials that are important to their functioning can best be studied with x-rays. Specifically, by studying how x-rays are scattered from and absorbed by different magnetic materials, scientists are able to look in detail at the separate contributions made by the electron orbit and electron spin to a material's magnetic moment -- data that are important for understanding how a magnetic material functions. In addition to understanding their functions, the very bright x-ray light produced by the synchrotron allows scientists to study very small samples. This is extremely important because technology trends are moving to smaller and smaller magnetic devices.

How will this help the future of magnetic media?

By understanding the properties of magnetic materials, scientists at the NSLS are hoping to develop faster, smaller, and higher capacity materials for the rapidly growing magnetic media industry.

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