

Tractor Beam?

Seems like it must be a magnet at first, but this is no magnet.

WHAT TO DO

A small disk is placed above a powerful magnet and levitates as though it's simply another magnet being repelled, but when the magnet is flipped upside-down the disk flips with it, remaining in exactly the same relative position- it's actually stuck in mid-air!

WHAT'S HAPPENING?

As you probably suspect, this disk is not a magnet, but contains a thin film made of Yttrium-Barium-Copper-Oxygen. When cooled below about -300°F it becomes a superconductor, i.e. electrons in the film are free to move with absolutely no resistance or loss of energy. When a normal superconductor is placed near a strong magnet the magnetic field is completely expelled from the material producing a repulsive force and the superconductor will levitate above the magnet (or vice-versa). This is called the Meissner Effect. In this very special type of superconductor, however, some of the magnetic field lines (or flux) leaks inside where it becomes trapped, essentially locking the disk's position relative to these field lines. As the magnet moves its magnetic field moves with it, and so does the superconductor- similar to the "tractor beam" in Star Trek movies. This strange quantum mechanical effect is called Flux Pinning.