## Academic Writing Course 2002

Teacher Raymond.W

Essay Topic: Enumerate on the development of electromagnetic matter manipulation and outline some of the benefits.

Due Date: 7:00pm 7<sup>th</sup> June 2002

Henri Shustak Student ID 0127449 Humans, unlike any other species on earth design and assemble tools. All tools allow us to either measure or manipulate matter. Curious from birth we quickly find obstacles, which prevent us from fulfilling our desires. Tools often help us surmount these obstacles. Our understanding of reality and the tools used to measure and manipulate it continually evolve. The following research reveals beyond reasonable doubt that the precision with which humans are capable of manipulating matter is governed by our understanding of electromagnetic fields.

The electric motor was one of the first electromagnetic matter manipulation tools. Andre Marie Ampere was the first to observe the electromagnetic reaction in 1820. A year later, Michael Faraday developed the first linear electric motor. Joseph Henri who worked closely with Faraday is attributed with developing the first electromagnet, an essential component of the telegraph, which he invented in 1830. Today electric motors can move in increments of less of less than one nano-meter. Electric motor research continues today. Therefore it is expected that the precision with which a motor can move will continue to increase.

The first medium to be intentionally manipulated with electromagnetic waves is the air. In 1876 Alexander Graham Bell unveiled the telephone, which translated sound (vibrations in air) into an electrical current sent along a wire and then translated the current back into sound. The speaker and the microphone are the key components of the telephone. Although sound reproduction is an active research field, the speaker and the microphone continue to limit the quality of reproduced sound that most people experience.

The progress within the field of electromagnetism paved a path for wireless communications. Our ability to wirelessly manipulate information is primarily due to our understanding of radio waves, which are part of the electromagnetic spectrum. In 1864 James Manjel took the first step on the path by developing radio wave theory. Then in 1888 Hertz established that radio waves move in straight lines, and that they can also be reflected. Oliver Lodge, Alexander Papoff and Gugliemo Marconi all made contributions to radio theory. However, Nicola Tesla demonstrated working wireless communication technology in 1893. Today wireless communication tools are common. Although radio is still a popular means for communication, there are other systems which are also widely used.

Today light is used to manipulate vast amounts of information on a daily bases. Marconi was the first to state that light is electromagnetic in nature. Today fiber optics, play an important role in information networks. John Tyndall gave birth to fiber optics in 1845 by demonstrating that light could be conducted though a stream of water. Recently in 1970 Roert Mautule, Donald Keck, and Peter Schulze developed the most widely used fiber optic cable. Precisely manipulating light is another active research area.

Lasers are a special kind of light, which is generated directly from electromagnetic energy. They have a wide range of uses, which include scanning barcodes at supermarkets, guiding missiles, and playing DVD's.

The microwave frequencies of the electromagnetic spectrum have the ability to excite entire molecules. Microwaves are also used in satellite communication. Many homes have a microwave oven, which excite water molecules. The molecules become hot, as they are excited. Radar "part of the microwave region of the electromagnetic spectrum"(NASA 1982), is used by the military and police during surveillance. Although microwaves do manipulate matter, the kinds of manipulations, which can be performed, are limited.

For centuries alchemists attempted to change lead into gold. Today it is not only possible to turn lead into gold but, it is also possible to transmutate radioactive waste. Powerful electromagnets make transmutation possible.

> Matter is a concentrated form of energy. It can be changed into other forms of energy and other forms of energy can be changed into matter-an equivalence embodied in Einstein's famous equation  $E = mc^2$ .(Chown, 2001)

Because all the elements on earth were transmutated from hydrogen in the sun, it is not unreasonable to assume that any element can be transmutated into any other element on earth, provided their is enough energy available.

Optical tweezing is technique, which allows further precision "manipulation of matter into complex two- or three-dimensional patterns and shapes containing large numbers of particles". (Spalding.G, 2002). Effectively allowing people to turn imagination into reality.

We pass laser beams through our own, computer-generated holograms to form a tailored array of functional "tractor beams" which cause nanoparticles to assemble themselves into a desired structure. In this manner, we produce holograms that are not merely ethereal images; they have corporeal substance and therefore constitute the first complete implementation of the Holodeck: 24th-century technology, slightly ahead of schedule. (Spalding.G, 2002).

Currently optical tweezing is being used in a verity of disciplines including medicine and optical telecommunications.

Particle accelerators, allow particle physicists to study atoms and subatomic particles. Although particle physicists are not currently able to manipulate enough particles to yield results, which are visible with the naked eye, their research is important in paving the path into a new age. Just as the industrial and information age have changed the way in which we live our lives. The matter revolution will be no exception. Because "without studies on the structure of the atom, lasers would not exist, and neither would CD players"(de Man.V, 2002)

Electromagnetic theory developments have caused major changes in the way people interact with the material world. Reviewing the developments in electromagnetic theory over the last two centuries, the link between electromagnetic theory and human beings ability to precisely manipulate matter becomes transparent. The real challenge is to use this technology to improve the life of everyone.

## Glossary

Electromagnetic reaction	Physical force is observed when a current is passed through a conductor located in a magnetic field.
Micron	On millionth of meter
Microphone	Transducer designed which converts sound energy into electrical energy
Microscopic	Not able to be seen with an unaided human eye.
Nanometer	One billionth of a meter.
Nanoparticles	When people talk about nano technology or nano particles they often refer to sizes between a nano meter and a micron, which is on millionth of meter. In some instances nanotechnology can even refere to objects which are microscopic. The quote "nanoparticle" from Spalding refers to particles less than 4 nanometers in diameter.
Speaker	Transducer, designed to converts electrical energy into sound energy.
Telegraph	Electronic bell activated by a switch, which can be located remotely.
Transparent	"allowing electromagnetic radiation of specified wavelengths to pass through" (Multiple Another's, 1999).

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