other aspect of the theories that describe how the universe works.

Recent Developments

One drawback in the use of SQUID is the requirement for superconductivity, which before recent advances in high temperature superconductivity was known to occur with predictability only in the presence of super cold (4.2° Kelvin) liquid helium. With the advent of high transition temperature (T_c) superconductors, however, our thinking on the applications of SQUID has expanded dramatically.

Recently, workers at IBM fabricated SQUID from yttrium- and thallium-based high-T_c materials that operate at much higher temperatures, around the boiling point of liquid nitrogen, or 77° Kelvin. While these types of SQUID are somewhat less sensitive than those fabricated from low-T_c materials operating at 4.2° Kelvin, they are still satisfactory for many useful applications.

The chief virtue of the higher temperature operation is not so much that liquid nitrogen is cheaper than liquid helium, but rather that the amount of cooling it provides is roughly 60 times higher. Consequently, a highly insulated container of liquid nitrogen could be expected to function unattended for very long periods, perhaps as long as 1 year or more.

This long running time makes it possible to undertake a large number of new measurement activities, which had been previously impractical, such as geophysical surveying operations with SQUID magnetometers in remote areas of the world where it is out of the question to use liquid helium cooled devices. It may now be possible to field magnetometers for long-term studies of geophysical phenomena, such as the change in magnetic field along earthquake-prone fault lines. Such studies could conceivably lead to new methods of earthquake prediction. The availability of liquid-nitrogen cooled devices makes them far more tractable for use in everyday measurements of physical qualities such as voltage and magnetic field as well as for instructional purposes in universities and high schools.

While the benefits to society of research are not primarily reflected by counting product sales, it is important to note that SQUID have also moved from the laboratory to commerce. For example, biomedical research now requires a production schedule of roughly 10 biomedical systems per year each containing many SQUID at a cost of 22 million dollars. The SQUID is an excellent example of how basic research can lead to wide ranging commercial applications in science, medicine, and technology.