temperature. EXAFS data analysis and multiplet simulation were done along with the demonstration of FEFF code of J. J. Rehr.

In addition to the above lectures, special lectures by L. Fonda on holography, G. Margaritondo on ELETTRA SR Facility and Aldo Crievich on introduction to Brazilian SR Facility at Campinas were delivered. ICTP had extended generously to all participants the Computer and Library facilities for the entire duration of the School.

The breadth of application of intense SR, extending from the infrared through the visible and ultraviolet part of em spectrum and deep into X-ray and gamma ray regions brought into the same laboratory scientists from diverse specialties such as surface physics, biology and materials science, etc. The extraordinary properties of SR and its rapidly-increasing availability throughout the world have a profound impact on a broad range of scientific and technological branches. ICTP school has succeeded largely in accomplishing symbiotically for a larger cooperation in the SR research.

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Compressed sulphur found to be a superconductor

A group of scientists from the Carnegie Institution and Russian Academy of Sciences report in *Nature* the surprising observation that sulphur becomes a superconductor at 93 GPa (9.3 million atmospheres). At this pressure, pure sulphur transforms to a superconductor with a T_c (critical temperature) of 10 K, or –263°C. As pressure increases, so does the superconducting temperature, at a rate of 0.06 K per GPa (up to 14 K). At a pressure of 160 GPa (the highest measured in the current experiments), T_c again increased to 17 K. In a related study, in *Phys. Rev. Lett.*, the same authors report the first measurements on a known superconductor, the metal niobium, above one million atmospheres (or one megabar) up to 132 GPa.

A material is said to be a superconductor when it loses resistance to electrical current flow. The phenomenon, one of the most non-intuitive in physics, has been recognized since 1911. Within the last decade, superconducting materials have been found at temperatures high enough to hold promise for energy-related applications, especially in the computer and electric energy fields. Most studies have focused on oxide-based ceramics.

The mechanisms of superconductivity in materials are of great theoretical interest but are, in many cases, in dispute. Studies of simple materials such as the pure elements that might superconduct, including an examination of the effects of pressure on T_c, are essential for understanding the underlying physics. Such studies, in turn, are crucial for designing new, technologically useful superconductors.

The authors of both papers are Viktor Struzhkin, Russell Hemley, Ho-kwang Mao, all of Carnegie's Geophysical Laboratory and NSF Center for High Pressure Research, and Yuri Timofeev, of the Institute of High-Pressure Physics, Russian Academy of Sciences. The group used the Geophysical Laboratory's megabar high-pressure diamond-anvil cell in conjunction with a magnetic susceptibility technique they have perfected over the past few years. The technique allowed them to determine the superconducting transition temperature without the need for placing electrical leads on the sample. Thus, they could perform their measurements on very small samples (down to 0.04 of a millimeter in diameter and a few thousandths of a millimeter in thickness). Tests of the method in the megabar pressure range (above 100 GPa) were done on niobium, which has a T_c of 9.5 K at atmospheric pressure but decreases to 4.5 K at 132 GPa (rather than increases).

Sulphur's transition from insulator to superconductor at 93 GPa was unexpected. Several years ago, scientists elsewhere had observed changes in optical properties of sulphur that suggested that the material transforms to a metal at about 90 GPa (at room temperature), with a corresponding change in crystal structure, and that it transformed to another structure at about 160 GPa. Recent theoretical calculations had predicted that sulphur would become a superconductor only at much higher pressures (above 550 GPa). The new results show that the material transforms directly from an insulator to a superconductor at the first transition (at 90 GPa). The results provide an important example of the large-scale changes in physical properties that can be induced by pressure.

The authors write in their *Nature* paper that their results are particularly notable because the metallic phases of sulphur have the highest T_cs of any elemental solid measured to date. Sulphur now joins the heavier members of its family in the periodic table of elements (the chalcogenide family, including selenium and tellurium), as a superconductor. This fact should provide critical tests for theories on superconductivity. In closing their paper, the authors write: 'Given the comparative simplicity of elemental sulphur for electronic structure calculations and knowledge of its high-pressure crystal structures, this element should provide important tests of possible new mechanisms.' The work is part of a much larger effort at the geophysical laboratory devoted to studying the behaviour of materials at ultrahigh pressures, including those that prevail deep within the planets.