Comparison of the sorption of water in silica-sodalite with its different pore-size characteristics with that in silicalite-1, which has two sets of channels, may lead to a better understanding of the reasons for the lack of hydrogen-bonding that must occur between water molecules sorbed in the silicalite-1 framework.

Second, since Engelhardt *et al.*[5] introduced solid-state magic-angle spinning NMR (MASNMR) six years ago, our knowledge of zeolite frameworks and the distribution of Al in these frameworks has been greatly enhanced. It is now apparent, however, that the complete analysis of these NMR spectra for structures that are not cubic and that contain more than one type of tetrahedral Si/Al site can only be accomplished if the spectrum of the pure silica form of the framework is available. Some success in producing pure silica frameworks has been achieved by dealumination of the aluminosilicate zeolites, but the process involves the annealing of many vacancies in the framework produced by the removal of Al atoms; it leaves material containing mesopores that must result in considerable lattice strain energy. The direct synthesis of some of these pure silica frameworks using organic solvents would enable a considerable advance in our use of MASNMR.

The spectra which have been published to date suggest that a simple relationship between Si-O-Si bond angles and chemical shifts must exist[6]. We await the production of good pure-silica framework crystals for the complementary X-ray and MASNMR studies required to establish this relationship. Such basic knowledge would be of immense significance in advancing our understanding of the chemistry of zeolites and other aluminosilicates. □

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Particle physics

The search for truth at Bari

from David J. Miller

Two kinds of 'truth' provided the major questions at the Bari High-Energy Physics conference*. Most interest was generated by the new 'Theory of Everything' — the superstring theory. It is a profound and beautiful piece of mathematics, but is it true? Observation of the 'truth' or 'top' quantum number is still not confirmed by experimenters at the CERN proton–antiproton collider. There were also useful warnings about ideas for future accelerators, three counter-results to a recent measurement of a large mass for electron–neutrinos, scepticism about the neutrinos which may be coming from Cyg X3, and a lot of sound data that reinforces the standard model of strong (quantum chromodynamics) and electroweak interactions with three generations of quarks, charged leptons and neutrinos.

A number of results reported from the CERN collider by the UA1 and UA2 experimental collaborators last year (see *Nature News and Views* **311,** 210; 1984) have not been confirmed by the new data. The identification of top or truth is particularly important because its is the only quark missing from the three generations. The UA1 experimenters do indeed have more events in the kinematic region where they claimed to find the signal for a $W^{\pm}$ boson decaying to top and antibottom quarks. In fact, they have too many events. There might be additional direct production of top–antitop pairs but if so, why do all of the events cluster close to the $W^{\pm}$ mass? L. DiLella (CERN), a member of UA2, reminded us that they still have not seen any convincing top-quark signal, and suggested that the current upgrading of both the detectors will help them sort out what is happening. A more secure, and very important, result is a measurement of the width of the Z° boson. Combining UA1 and UA2 results, it has been possible to use this width to put a limit of 2·4 on the number of extra generations of light neutrino, beyond the three of the standard model, with 90 per cent confidence (experimental) and with a theoretical uncertainty of ± 1.

It was difficult to get the particle theorists to talk about anything else but superstring theory. There is still a lot of work to be done according to M. Green (Queen Mary College, London), one of its inventors, but it has already been successful in overcoming the problem of anomalies at the Planck scale, where all previous attempts at a quantum theory of gravity have failed. Its fundamental symmetry is that of vibrating strings in a ten-dimensional space. Six of these dimensions have to be curled up to regain four-dimensional world, but there should then be no free parameters. The arbitrary features of the standard model, such as the number of generations, fermion and boson masses, should all be determined by the properties of the Calabi–Yao manifolds in the six curled-up dimensions. Unfortunately, there are ten thousand Calabi–Yao manifolds, and it is taking a little while to pick the one that corresponds to the properties of the particles we know. But when it is picked, as one theoretician pointed out, experimental particle physicists may all be able to retire.

Experimenters, used to the rapid appearance and disappearance of ambitious theories, were more concerned with immediately testable predictions. So far, the only predictions are the same as those of supersymmetry, which is contained within superstring theory, but despite searches for supersymmetric effects nothing definite has been seen.

The sure way to find out what lies beyond the standard model is to raise the experimental energy into the region where the Higgs fields, or their supersymmetric equivalents, must become accessible. A number of speakers, notably J. Lawson (Rutherford Appleton Laboratory), demonstrated that hard and calculable limits exist to what can be achieved by any accelerating device. To use the high electric fields that might be available from a 'wake-field' or a 'beat-wave' accelerator, it will be necessary to develop new beam-focusing techniques, more efficient lasers or radio-frequency cavities and much brighter particle sources than are now available. What is needed is a fundamental development — like the discoveries of strong-focusing or stochastic cooling. Fundamental problems in a colliding-beam machine include 'beamstrahlung', the energy loss of particles in one bunch due to the collective magnetic field of the opposed bunch. There is a possibility of overcoming this for the majority of particles in each bunch by using quantum effects, but only if the beam bunches are less than a micrometer long and a few angstroms across. No one yet knows how to make such tiny beams.

The Kendrew report on high-energy particle physics in the United Kingdom was debated briefly. The suggestion that particle physicists should collaborate more with industry and with other sciences was well received, and in the accelerator and detector sessions many examples of such collaboration were reported—such as the phototriodes developed by the Rutherford Appleton Laboratory in collaboration with Philips. Kendrew's negative conclusions about the rate of expenditure on the field were thought not to have had too much influence outside Britain, although in his final review talk A. deRujula (CERN), commenting on the apparent rapid reduction in flux of the pulsed gamma-ray source in Cyg X3, suggested that the Galactobritannic Empire' had decided to close down the accelerator, just as we thought we might be detecting its neutrino beam. □

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