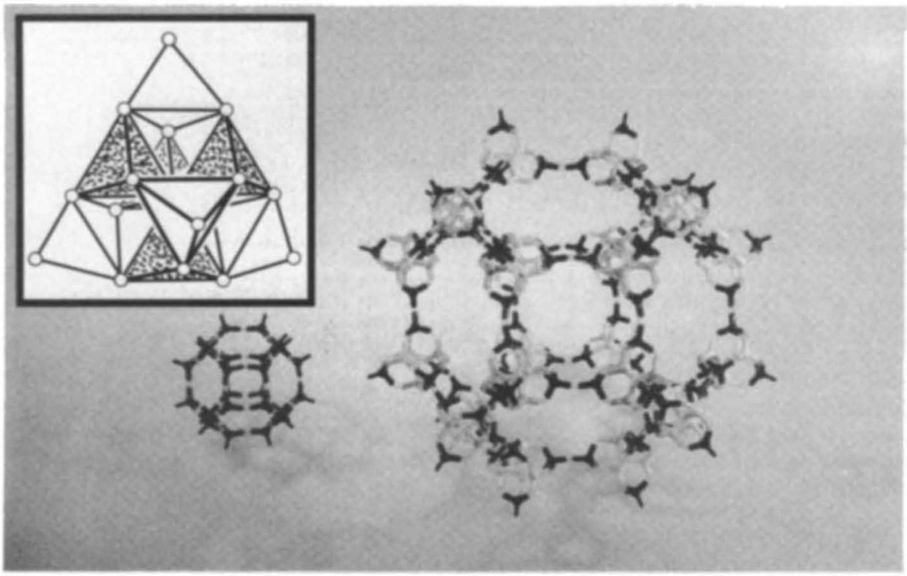

Inset is sketch of $[Be_4Si_4O_{17}]^{10-}$ ion (ref. 6): BeO_4 tetrahedra are shaded and SiO_4 tetrahedra unshaded. Main photo shows the cage in the sodalite structure (left), and in expanded form (right).

hedra, and the fourth corner is free. This polyanion has the same symmetry as a regular tetrahedron (point group T_d) and can be regarded as a 'supertetrahedron' comprised of eight tetrahedra.

If every tetrahedron in a zeolite net is replaced by this supertetrahedron, a new, expanded net is generated. This procedure can be repeated an infinite number of times, but only the first expansion will be considered here. If the unit cell of the original net contains n tetrahedra, the expanded net will contain $8n$ tetrahedra and the unit-cell content will change from T_nO_{2n} to $T_{8n}O_{15n}$. The maximum symmetry of the net will not change, but the multiplicity of the rings will increase by a factor of three: for example, the 4- and 6-rings in the sodalite-type frame are transformed into 12- and 18-rings (see figure). The framework density (number of tetrahedra per nm^3) ranges from 12.5 to 29.0 in known framework structures[7]. Introduction of the supertetrahedron involves a linear expansion by a factor of about 2.7, and thus the original framework density is multiplied by a factor of $8 \times 2.7^{-3} = 0.41$ (assuming a rigid framework). Each supertetrahedron contains no less than twelve 3-rings, in agreement with the conclusion[7] that very open tetrahedral networks (with two-coordinated oxygen atoms) contain a maximum number of 4- and/or 3-rings. The four-coordinated oxygen atom in the T_8O_{17} unit would bring a novel feature to the field of zeolite-type nets.

STAFFAN HANSEN

Inorganic Chemistry 2, Chemical Center, University of Lund, PO Box 124, S-221 00 Lund, Sweden

1. Smith, J.V. *Chem. Rev.* **88**, 149–182 (1988).
2. Barrer, R.M. & Villiger, H. *Z. Kristallogr.* **128**, 352–370 (1969).
3. Smith, J.V. & Dytrych, W.J. *Nature* **309**, 607–608 (1984).
4. Meier, W.M. *Pure appl. Chem.* **58**, 1323–1328 (1986).
5. Davis, M.E. *et al. Nature* **331**, 698–699 (1988).
6. Frostäng, S. *Chem. Comm. Univ. Stockholm No. 3* Jan. 29, 1–72 (1990).
7. Brunner, G.O. & Meier, W.M. *Nature* **337**, 146–147 (1989).

Cosmology theory compromised

SIR—A curious dynamic tension has been rising in the field of cosmology. Some widely held theoretical assumptions are coming into increasing conflict with observational results, and yet those assumptions continue to receive strong support. Consider three prime examples.

(1) Various empirical tests suggest that the cosmological mass density parameter Ω is less than 1. Theoreticians have argued that Ω almost certainly has a value of 1. This conclusion stems from the fact that the 'inflationary scenario', which rescues the Big Bang theory from several serious difficulties, and the cold dark matter theory, which is used to explain the formation of galactic scale structure, are highly dependent upon the value of 1 for Ω. But, an objective weighing of the empirical evidence[1,2] on Ω suggests that $\Omega \leq 0.3$. Do we put our trust in theoretical assumptions or in observational results?

(2) Recent observations seem to favour baryonic dark matter. Hypothetical non-baryonic particles, such as weakly interacting massive particles (WIMPs), have been vigorously advocated as the most likely candidate for the unseen dark matter which dominates the mass of the Universe. But there have been many non-detections and ever-narrowing empirical constraints. A remarkable set of observations by Tyson *et al.*[3] show that the distribution of the dark matter in tested galactic clusters closely parallels that of cluster red light (baryonic matter). The most straightforward interpretation of this result is that the dark matter is baryonic. Given that there is no empirical evidence for non-baryonic dark matter, and some evidence against it[1,3], should it still be our best candidate?

(3) Something seems to be amiss with the Big Bang paradigm. This paradigm has always faced some theoretical problems: the horizon problem, the flatness problem, the smoothness problem and a postulated acausal beginning to the Universe. But a new set of empirical challenges has recently arisen: a Universe dominated by unpredicted dark matter, unanticipated large-scale galactic streaming, globular star clusters that are estimated to be as old as 18×10^9 years, large scale ($\geq 10^2$ megaparsec) structure[1] far exceeding original predictions and, ironically, a microwave background radiation that is too homogeneous.

The inflationary model and the cold dark matter model were created to save the Big Bang paradigm from conflict with many of these findings. But given the difficulties mentioned above with which these supplementary theories are now beset, their ability to aid the Big Bang paradigm is in some doubt.

At this crucial juncture comes an observational result[4] that leaves almost everyone scratching their heads: the apparent detection of a periodic pattern of galactic clustering that is maintained over scales of the order of 10^3 megaparsecs! Certainly, it appears that the observable part of the Universe has expanded from a far more compact state, beginning about 10^{10} years ago. But beyond these very modest empirical constraints lies speculation and the unknown. Do we continue to pretend that we have just about got the Universe figured out?

The underlying theme of these three examples is the idea that we may have already passed the point at which it is appropriate for observational results to take precedence over theoretical constructions. There is not yet enough empirical evidence for conclusive scientific decisions on these three issues, but surely science would be better served if a greater attempt was made to loosen the grip of prevailing prejudices.

ROBERT L. OLDERSHAW

Box 2262, Amherst College, Amherst, Massachusetts 01002, USA

1. Geller, M. & Huchra, J. *Science* **246**, 897–903 (1989).
2. Dressler, A. in *Astronomy, Cosmology, and Fundamental Physics* (eds Caffo, M., Fanti, R., Giacomelli, G. & Renzini, A.) 23–40 (Kluwer, Dordrecht, 1989).
3. Tyson, J.A., Valdes, F. & Wenk, R.A. *Astrophys. J.* **349**, L1-L4 (1990).
4. Broadhurst, T.J., Ellis, R.S., Koo, D.C. & Szalay, A.S. *Nature* **343**, 726–728 (1990).

■ See also "The extragalactic Universe: an alternative view", page 807.