

Fight for tape recorders

Dwingeloo (Netherlands)

IMPROBABLY hidden in the pine-woods south of this hamlet near Groeningen is a radiotelescope and a smattering of low-built offices. The site is that of a European collaboration of radioastronomers who may yet be able to build a gigantic tape-recorder allowing a score of observatories elsewhere in Europe to pool their signals in the astronomers' common cause of seeing further. But the cause has been cruelly frustrated.

Dwingeloo is also the headquarters of the European Consortium for VLBI (for Very-Long-Baseline Interferometry). The technique of correlating accurately timed signals from several radiotelescopes, all pointing in the same direction, makes the accuracy of the position of a simultaneously observed radio source greater than the sum (in any sense) of the accuracy of the separate observations. The headquarters of the Netherlands Foundation for Radio Astronomy (NFRA) is also sited at Dwingeloo.

The European Consortium is, just now, at its wits' end because of uncertainty over its plans for the future. Last year, it applied to the Stimulation programme of the EEC for funds to finance its technical development. But the EEC Commission said "No".

In reality, the VLBI Consortium is a club. The founder members are the observatories at Bologna, Effelsburg (near Bonn), Dwingeloo, Jodrell Bank and Onsala (Sweden), and associate members include the Paris Observatory (Meudon) and institutes in Moscow and Poland. The six regular collaborators have committed between a quarter and a third of their observing time to VLBI. Projects are put forward by astronomers individually, and assessed by a programme committee. Richard Schilizzi, project manager for NFRA at Dwingeloo, says that the consortium is two to three times oversubscribed on a 24 hours a day basis. Moreover, the network is growing rapidly.

Like all VLBI collaborations, the club's collective ambition is so to improve on the accuracy with which measurements of the position of distant radio sources are made that the large-scale yardstick of the structure of the Universe will be better known, nearby galactic and even stellar phenomena will be better understood and the year-by-year movement of the Earth's tectonic plates will be more accurately measured.

The European Consortium is anxious not to be left behind by its competitors, the chief of which is that in the United States. Europeans are envious of the US VLBA (Very-Long-Baseline Array) project, which is now building ten 25-m dedicated radiotelescopes operating in

nine frequency bands between 1 metre and a few millimetres.

From the outset, VLBI techniques have been especially valuable in mapping the structure of distant quasars and other active galaxies; Schilizzi says the recent observation by VLBI of extragalactic water and hydroxyl masers offers a chance of constructing an independent and objective distance scale for the Universe.

So, with all that promise, why are people so glum? The difficulty is that the analysis of VLBI data is becoming steadily more complex — and expensive. Collaboration requires that each observatory should have a decent clock and a more than decent tape-recorder.

With the development of millimetre-wavelength telescopes (which improves the resolution of the system), recorders must be capable of storing huge amounts of data — 512 megabits a second is the new standard, which is roughly the information content of 100 standard video signals. But then it is necessary centrally to correlate up to 20 of these recorded signals electronically, which means synchronizing and then multiplying together each pair of signals from the contributing observatories.

The 18 million ECU for which the European Consortium applied last year would have been spent on the development of the tape-recorders and the correlator followed by their installation at Dwingeloo. The consortium points out that the only correlator in Europe at present capable of dealing with millimetre-wavelength signals is that at Effelsburg, which can handle signals from only three independent telescopes and which is, in any case, fully extended.

Schilizzi says that it is essential that the project should cover the cost of providing each of 11 telescopes with a tape-recorder (and a spare). Otherwise, he says, national grant-making agencies would skimp on the cost, and the resulting non-standard equipment would yield signals that could not easily be compared.

There is a Euro-industry argument on the consortium's side: broad-band recording techniques and equipment will be in great demand as high-definition television gets under way. So why not put some millions of ECUs into the development of such machines, equip a score of observatories with them more cheaply than they could be bought and leave some European manufacturer with an expertise now lacking?

It seems generally agreed, even in Brussels, that the argument is appealing. People have plainly listened to it attentively — and have then decided that there is nothing they can do. But the last has not been heard of Dwingeloo's ambitions. □

Monastic calm and money worries

Paris

JUST a 20-minute train journey from the centre of Paris in 11 hectares of parkland lies what has been described by its director, Marcel Berger, as "a monastery and a beehive" — the internationally renowned Institut des Hautes Etudes Scientifiques (IHES). The paradoxical metaphor is justified.

On the one hand, the institute provides the isolated calm necessary for profound meditation on theoretical problems, while the six permanent fellows last year attracted 872 researchers from 42 countries to exchange ideas in the vanguard of mathematics and theoretical physics.

Inspired by the Institute for Advanced Study at Princeton, IHES was set up in 1958 by Léon Motchane, Jean Dieudonné and Robert Oppenheimer as a European centre of excellence in mathematics and theoretical physics. The Second World War had seen some of Europe's most able scientists seek refuge in the United States; naturally, there were fears that the centre of gravity of science would move irretrievably across the Atlantic. In poetic justice, IHES stands on the site of a chateau commandeered by the Nazis during the occupation.

Very much like its Princeton model, IHES has a small number of permanent fellows on comfortable stipends for life — although mathematician René Thom is the first to continue to retirement so far, becoming an honorary fellow this year.

Fellows are free from all teaching and administrative obligations and do not have to account for their time, apart from an undertaking to spend 6 months of the year at the institute. In practice, they have catalysed revolutions in their specialisms. During the 1960s and 1970s, for example, the institute established itself as the world's temple of algebraic geometry, through Alexandre Grothendieck, Jean Dieudonné and Pierre Deligne.

Although fellows leave an indelible mark on the choice of themes, these have evolved over the years, aided by the presence of a handful of invited long-term visitors who stay for around five years, and a long line of visitors spending up to a year at the institute.

Today, the permanent fellows are Jean Bourgain, Mikhael Gromov, Louis Michel, David Ruelle and Dennis Sullivan. This year, theoretical physicist Thibault Damour fills a vacancy left by Oscar Lanford, opening a new avenue of research in general relativity and cosmology.

The institute's private status is anomalous, for 64 per cent of its FF19,287,000