NEWS AND VIEWS

Happy Birthday, Pulsar

It is now twelve months since the discovery of four pulsating radio sources was announced in *Nature* (**217**, 709; 1968). It has been a memorable year. Pulsars burst on the scene not gently like the quasars whose baffling qualities only gradually became apparent, but in a single paper which picked out a sprinkling of properties in a study of *CP* 1919 and also hinted darkly at the presence of three more. So theoreticians had a head start at the problem, and it would not be too rash to hope that in the rotating neutron star hypothesis there are the bones of a solution. Even so, everyone admits that there is still plenty of scope for the sort of idle conjectures which are now familiar not only at the Royal Astronomical Society but also in all kinds of situations, domestic as well as professional.

It is probably good, however, that the flood of papers which marked the first twelve months is showing signs of slowing down. Granted that spinning neutron stars are the works of the clock mechanism, what is needed now is a convincing description of how the spinning star produces the sorts of signals which are picked up by radio and now optical telescopes. There is still room for upsets, and many people would be glad if there were. The thrill of the chase is, after all, as exciting as the capture. The optical flashes, for example, which are only now being measured, are likely to be as fascinating as the radio pulses. An optical spectrum of the flashing pulsar has yet to be published, for instance.

To those case-hardened to the quirks of scientific investigation, it is no surprise that pulsars should have been discovered in the course of a study of the interplanetary medium in which the solar system is enmeshed. Of course, the point is that the "hop-field" aerial at Cambridge was unconsciously built to look at just the sort of fluctuating signals which pulsars generate. Built up of a rectangular array of 2,048 dipoles in sixteen rows of 128 elements, the metalwork of the aerial is difficult to discern among a forest of supporting sticks. To pick up scintillation caused by the interplanetary medium, the recording instruments had to have a short time constant, and this as much as anything made possible the detection of pulsating signals which conventionally would have been blurred out.

Although anniversaries are times for looking forward as well as back, it is impossible to predict what the pulsar situation will be in a year or so. One thing that does seem likely, however, is that the problem will be as much the domain of the physicist as the astronomer. The attraction is in learning something about degenerate matter—matter in the highly compressed state already known in white dwarf stars, carried to the extreme in neutron stars and which cannot be studied in terrestrial laboratories. Astronomers, on the other hand, will be fitting pulsars into the jigsaw of stellar evolution and—more pragmatically—looking for an explanation of the energetics of the Crab nebula in terms of the pulsar within it. But the excitement which the pulsars have engendered has also helped to answer some awkward questions about the function of those enormous aerials. It looks as if radio astronomers are now successfully justifying their equipment to the taxpaying public on its merits.

METALLURGY

Mathematical Smelting

from a Correspondent

A GROUP of metallurgists, physicists and engineers from the major steel producing countries of western Europe has been meeting informally since 1963 to discuss the mathematical simulation of large scale metallurgical processes. These meetings culminated in a conference on "Mathematical Models in Metallurgical Process Development" held in London last week to demonstrate progress in the use of basic scientific and engineering principles to represent mathematically complicated high temperature processes. The models presented were designed to simulate the metallurgical processes involved and to provide data that can be used in the design of new processes. Most of the papers were concerned with the unsteady state of heat transfer, both in solidification and in heat treatment or hot working.

The conference began well with an introductory paper on differential equations and the formulation of mathematical process models by J. D. Tocher of the British Steel Corporation. Due regard was also paid to the fact that the physical processes must be understood before a mathematical model can be formulated. Details that would seem trivial to a plant operator are thus important to the "process modeller", and this was reflected in the fascinating detail with which several of the papers dealt with this subject. The concern of the process modeller for accurate numerical data was shown in two papers on continuous casting; one on steel by J. J. Gautier *et al.* from IRSID in France and the other on aluminium by D. A. Peel and A. E. Pengelley of the British Aluminium Company.

A paper by A. Kappelmayer and E. E. Hofmann of the Technical University of Berlin was concerned with a mathematical model of hot blast stoves. This shows how the cross-flow in the checkers should be taken into account in such a model. Nearly all the papers contained accurately measured plant data for carefully defined conditions.

It is less easy to enthuse over the mathematical techniques used. Most of the papers presented explicit finite difference solutions to non-linear forms of Fourier's unsteady state heat conduction equation, which arise in casting or heat treatment through the evolution of latent heat during solidification and solid state transformations. It was somewhat disappointing