or more complex stars which exchanged the mechanical energy of their motion into heat so that X-rays were then generated by thermal bremsstrahlung.

The interpretation of the diffuse background is important for cosmologists because it contains information about distant radio galaxies and the universe as a whole. Dr D. W. Sciama, from the University of Cambridge, thinks that the high energy (>1 keV) X-radiation probably arises from inverse Compton scattering between cosmic photons and relativistic electrons in very distant radio sources. The low energy background may also be extra-galactic but it might arise in a dense hot intergalactic gas.

Ground-based instruments are used to study high energy X-rays and Dr J. V. Jelley, working at Harwell with scientists from the Smithsonian Institute, has just developed a simple and cheap ground-based technique based on measuring X-ray induced fluorescence in the upper atmosphere which has, potentially, the sensitivity of current rocket-based experiments. They intend using the technique to search for X-ray emission from pulsars.

Balloons and rockets have been used to study X-rays with energies as low as 0.25 keV—the limitation on these techniques is the stability and pointing ability of the vehicles. Stabilized rockets allow observing times of ten to a hundred seconds and the most sensitive instruments on them can detect fluxes of 10^{-2} photons $\text{cm}^{-2} \text{sec}^{-1}$. Sensitivities as high as 10^{-4} photons $\text{cm}^{-2} \text{sec}^{-1}$ should be obtained from instruments on satellites which can be stabilized to give observing times of hours. The first satellite carrying X-ray detectors—an orbiting solar observatory—should fly by 1970, and experiments have been designed for satellites scheduled to fly early in the 1970s. Dr Pounds and his group at Leicester have developed a modulation collimator to measure the positions of sources to an accuracy of 15 seconds of arc. Interest is growing in the use of reflexion telescopes to measure spectra although these require a lot of space and possibly manpower for final adjustments and focusing. Dr Friedman said that the Americans are more interested in flying manned workshops than unmanned experiments.

FLUIDICS

Liquid Logic

from a Correspondent

THE technology of fluidics and interest in its applications continue to develop in spite of forecasts to the contrary—"ten years too late", "uneconomic and unreliable" or "electronics more flexible". Problems abound: inadequate understanding of jet entrainment, secondary flows and unsteady state effects, "noise" generation and the like. The president of the Royal Aeronautical Society, Professor D. Keith Lucas, in his opening remarks at a symposium held recently, pointed out that there are many circumstances—notably in the field of aeronautics—in which fluidics might best satisfy engineering requirements. With better understanding of flow phenomena and improved design and construction methods for fluidic components, more accurate and reliable performance of sensing, computing and control equipment is certainly being attained, as the proceedings of the symposium showed.

The symposium, which was organized by the Royal

Aeronautical Society under the aegis of the United Kingdom Automation Council, is the first on fluidics to be sponsored by the International Federation of Automatic Control. The subject—not originally under its present title—has featured at each of the three IFAC Congresses (Moscow 1960, Basle 1963, London 1966), and indeed first attracted widespread attention as a result of work displayed at the Moscow Institute of Automatics and Telemechanics in 1960. A specialist international meeting was overdue: in the event about 150 people from 14 countries registered for it. Out of some 50 offers of papers, 23 from 10 countries were accepted.

The papers were grouped under three headings, "Fluid Mechanics", "Components and Systems Design" and "Applications". The development of fluidics has been to some extent handicapped by the scarcity of people with knowledge of spanning fluid mechanics and automatic control. The symposium was quite successful in bringing together people from both backgrounds. Even so, the divergence of attitude between the systems engineers, who were trying to meet engineering specifications and sell their wares, and the fluid mechanicians, who sought a better understanding of relevant flow phenomena and related design criteria, was apparent throughout the discussions. One must hope that each group left the meeting with a better awareness of the importance of collaboration.

In the fluid mechanics group the papers represented topics of current interest. A paper by R. D. Begg from the United Kingdom, on the prediction of downstream pressure asymmetry effects on jet flow, attracted most discussion. The misleading consequences of incorrect appreciation of theory were pointed out by T. Sarpkaya, from the United States, in one of his many stimulating and sometimes provocative contributions, in comment on a paper by absent authors L. A. Zalmazan, N. N. Ivanov and M. E. Limonova, of the USSR.

In the papers on components and systems design, many experimental results were presented, but the gap between research and *ad hoc* development work was all too clear. Noteworthy results are, however, being achieved; C. Pavlin and P. Facon of France described work on curved-wall amplifiers with flat response to 1,600 Hz for use in adverse environments on rockets, and A. Colamussi of Italy described an RC-type fluidic delay element for use in sequential logic circuits, accurate to 1 per cent.

IONOSPHERE

A Better Ionosonde

from a Correspondent

A new type of ionosonde which is potentially capable of great accuracy in measurements of the height of ionized regions has been constructed at the University of Queensland in Australia by E. Kantarizis, D. W. Rickard and J. D. Whitehead of the Department of Physics. The design is based on a suggestion made several years ago by J. D. Whitehead and A. Malek (*J. Atmos. Terr. Phys.*, **25**, 599; 1963). Called the phase ionosonde, the new instrument, built with the help of research grants from the US Army and the Radio Research Board of Australia, has a theoretical error of about 100 m for F-region measurements and