Proudfoot and Brownlee (*Nature*, **252**, 361; 1974) have sequenced the 3′ end of purified rabbit β-globin mRNA next to the poly(A) region and compared it to the sequence of bases in the same position in mouse immunoglobulin light chain mRNA (Milstein *et al.*, *Nature*, **252**, 354; 1974). They did not sequence the RNA directly but transcribed it into DNA using *E. coli* DNA polymerase I and deoxytriphosphates, one of which was labelled with ^{32}P.

Comparison of the two sequenced regions of each messenger showed that two sequences (7 and 4 bases long) were common to both messengers. As well as this sequence homology Proudfoot and Brownlee suggest that structural homology exists since both the light chain and globin 3′ ends can be drawn with loops which are identically positioned and almost the same size in the two mRNAs. Most of the homologous sequence is probably in the unpaired region.

The apparent contradiction between these authors' results and those of Nichols and Eiden will probably disappear as the sequences of the 3′ ends of more messengers become available.

Laser tuning

from John Walker

MOST lasers have the disadvantage of operating at only a few fixed wavelengths. Dye lasers on the other hand can now be tuned over the whole visible spectrum by selecting appropriate dyes. Fine tuning is accomplished by a variety of techniques, one of which involves birefringent crystals. A recent paper (Tang and Telle, *Applied Physics Letters*, **24**, 85; 1974) reports the observation of very large tuning rates using birefringence in ammonium dihydrogen phosphate (ADP).

Earlier work needed high gain pulsed dye lasers and used rather complicated tuning elements including intracavity polarisers and gratings. Tang and Telle employed a less powerful CW dye laser, and only a single z-cut electro-optic crystal of ADP. When the z axis was parallel to the direction of propagation of the light a voltage applied across the x direction had no effect on the laser wavelength, as symmetry considerations would predict. But if the crystal were misaligned by only one degree the wavelength then unexpectedly became a very sensitive function of voltage. Tuning rates of up to 60 Å kV^{-1} were achieved, and they could be varied by changing the misalignment angle. Coarse tuning could be effected by rotating the ADP crystal. The precise explanation of the tuning effect is not known, but it seems to depend on having a crystal with very low residual birefringence in the absence of an electric field.

In any case, the method seems to be simple and useful, as Tang and Telle demonstrate in a second paper (*J. Appl. Phys.* **45**, 4503; 1974). Here they claim the first application of a laser to modulation spectroscopy, a technique which previously needed conventional light sources and spectrometers. The principle of modulation spectroscopy is quite simple. The spectrometer (or in this case laser) wavelength is caused to oscillate rapidly over a range of a few Ångstroms. Using suitable electronics a signal corresponding to the first derivative of the absorption spectrum can then be extracted from the transmitted light. In practice this means that relatively weak spectral features are amplified and made visible. Tang and Telle studied the room temperature absorption spectrum of Nd^{3+} ions in a YAG crystal. They were able to resolve features which are normally seen only at liquid helium temperatures, and also detected some weak lines which are not usually seen at all.

The claimed advantages of the laser system over conventional modulation spectrometers are greater sensitivity because of the intensity of the laser light, and much better resolution. As a straightforward tunable laser the line width can be reduced to less than a tenth of an Ångstrom. The voltage tunability ensures very fine and reproducible wavelength selection. This versatile tuning system will undoubtedly find many applications.

Classical relativity in an up-to-date context

from W. H. McCrea

THERE has recently appeared a substantial paper by F. Salzman "Gravitational Field of a Freely Moving Mass" (*Il Nuovo Cimento*, **24B**, 157–188; 1974); the treatment is intended to be that of standard general relativity, howbeit with emphasis on the dynamical rather than the geometrical point of view, and the application is mainly to the case of a Schwarzschild mass. In days when there is so much interes in the gravitational and dynamical properties of black holes, such a study of intimately related problems would be expected to be particularly timely and significant. Indeed, the surprising thing is that the problems have not long ago been fully investigated. Nevertheless, while the paper is of much interest in an exploratory way, it seems that definitive results are scarcely yet achieved.

Some of the immediate background theory is quoted from the well-known books by C. Møller and by L. D. Landau and E. M. Lifshitz and some generally relevant ideas from the writings of F. A. E. Pirani and S. Weinberg. But the central exercise of the work seems not to have been attempted before: it is to study the consequences of as nearly as possible applying a Lorenz transformation to the Schwarzschild exterior solution, seeking thuswise to obtain a metric that might be interpreted as that of a mass in free (unaccelerated) motion. The procedure is to express the Schwarzschild solution in terms of the usual time coordinate and Cartesian-like spatial coordinates, and simply to apply a Lorentz transformation to these. Since the space-time tends to that of special relativity at large distances from the mass, the transformation has asymptotically its usual significance. The spatial coordinate system is not unique, but Salzman seeks to treat the passage from one to another admissible system as being analogous to a gauge transformation in electromagnetism. The two cases he treats in detail are "Schwarzschild coordinates" and "isotropic coordinates".

Except asymptotically, the transformation has none of the precise significance of the Lorentz transformation in special relativity. Of course, it may be qualitatively suggestive. One feature Salzman discusses that at first sight offers intriguing possibilities is a generalised Schwarzschild surface defined by the vanishing of the leading component (coefficient of the dt^2 term) of the metric tensor. In the coordinates used, however, this tensor is not in diagonal form, and so the vanishing of this component does not in general denote a singularity and therefore need not have any particular physical significance.

As regards the behaviour of a test particle in the field of a freely moving Schwarzschild mass, all the physical properties are derivable using any admissible coordinate system whatever. Since one is interested in only the relative motion of the particle and the mass, by far the most convenient system is the original Schwarzschild one where the metric takes the familiar form:

$$ds^2 = (1-2M/r)dt^2 - (1-2M/r)^{-1}\, dr^2 - r^2 d\Theta^2 - r^2 \sin^2\Theta d\Phi^2$$

with $c = G = 1$.

One relevant matter is the case of