it evident that there is no great interaction between the vibrations of the HO and DO valence bonds. One fact which cannot be explained is the splitting of the bending vibration. Each of the three molecules shows, as with the ice crystals of type b, satellites on the short wavelength of about the same intensity ratio. As the bands are sharp and coincide with the frequencies of the vapour state, there can be no *hydrogen* bonding. But the highly polar antimony trichloride molecule certainly would associate with the water molecule. This association must therefore take place by some sort of *oxygen* bonding to the antimony atom. The splitting may be originated by a coupling effect of the antimony atom. A further point of interest is the same intensity ratio of the satellite to the main absorption band in each isotopic molecule. Without going into further details, I would call attention to the following fact which has not yet been fully realised :

From an infra-red spectrum we get two main kinds of information : (a) normal frequency and (b) total intensity of a band.

The square of the frequency of a normal vibration is, as is well known, proportional to the force-constant (f) and to the reciprocal mass (1/m) :

$$(a) \quad (2\pi\nu)^2 = f \cdot \left(\frac{1}{m}\right).$$

On the other side, the square of the vibrating charge (e) is also proportional to the same force-constant and to the polarisability α of the normal mode :

$$(b) \quad (e)^2 = f \cdot \alpha.$$

The polarisability of a vibration can now be quite easily measured by the total integrated intensity over $d\lambda$ of the band :

$$(c) \quad \alpha = \frac{3}{8\pi^3 N} \int \epsilon_\lambda d\lambda$$

$$(d) \quad (2\pi e)^2 = f\left(\frac{3}{2\pi N}\right) \int \epsilon_\lambda d\lambda.$$

(ε—molar extinction coefficient ; N—mole-number).

If, therefore, the effective electrical charge of the vibration is *not* dependent on the amplitude of the vibrating mass, the isotopic compounds must have the same intensity in the corresponding bands. As we now have found a solvent which will dissolve water and other simple compounds quite readily in different concentration, we are now able to go into studying this intensity phenomenon of the infra-red spectra of deuterated simple compounds and we shall do so.

1. Mutter, R., Mecke, R. and Luttke, W., *Z. f. phys. Chem.*, Neue Folge, 1959, 19, 83.
2. The spectra were taken by Dr. E. Klee at my Institute.

ROCKET TO VENUS

WHAT indeed was a significant step forward in space research was the launching of a rocket to the planet Venus by Russia on February 12, 1961. The method of launching itself was unusual and showed the greatest scientific precision involved. The "interplanetary station", as the rocket is called, was launched from a heavy artificial satellite which was put in orbit round the earth earlier in the day, by an improved multistage rocket.

The weight of the automatic interplanetary station is 643·5 kilograms (1420 pounds). Radio transmissions from the Venus rocket are made on the frequency of 922·8 kilocycles on command from the earth. According to the Russian announcement the purpose of the rocket was to carry out a programme of physical observations in outer space. On February 17th the announcement said that the interplanetary station had travelled a distance of about 1,173,000 miles and was going at a speed of 2½ miles per second, and that the equipments, actuated by solar batteries, were functioning normally. The rocket is expected to reach the area of the planet Venus in the second half of May, 1961.

One result of the revolutionary "double system" used in launching the Venus probe is a one-third reduction in the time previously considered necessary for the trip from Earth to Venus. It was calculated by Soviet scientists that with an estimated initial speed of 12 km. per second, the trip to Venus would take 146 days on the most economical orbit. Thus the utilisation of a space platform to launch the actual Venus rocket has permitted an increase of the "breakaway" speed and correspondingly reduced the flight time to Venus.

Venus is nearly of the same size as earth, its diameter being 7,600 miles. Its mean distance from the sun is 67 million miles and its orbit is almost circular ; its period of revolution round the sun is 225 days. Its distance from the earth varies from a maximum of 160 million miles to a minimum of 26 million miles. It comes closer to the earth than any other planet. Venus is currently on one of its closest approaches to the earth, about 35 million miles away.