that of the known variable magnetic stars. The observations on which this discovery depends were made between 1950 and 1966, when observers at the Lowell Observatory kept a close watch on the brightness fluctuations of Uranus and Neptune. It is more convenient to observe these planets than the Sun directly because the brightness of the reflected light can be directly compared with the known brightness of fixed reference stars in the same field of view. These observations have only recently been analysed statistically, and now R. Albrecht, H. M. Maitzen and K. D. Rakos have discovered two linked patterns within them (*Astronomy and Astrophysics*, **3**, 236; 1969).

First, there is a relatively large variation (which is nonetheless a minute part of the whole) that takes place over a period of eleven years and must be associated with the sunspot cycle. Second, there is a smaller perturbation on top of this variation, the exact period and amplitude of which depends on the stage reached in the sunspot cycle.

Because this rapid fluctuation always has a period in the range 25 to 30 days, it ties in well with the widely held view that the core of the Sun is rotating fairly rapidly, completing about one revolution per month, because the magnetic field linking the core and solar surface should produce observable effects with just this period. It has also been suggested recently that the brightness variation in magnetic stars could be caused by the build-up of many large "starspots" which would reduce the average temperature of the stellar surface, because the material in spots is always cooler than the surrounding surface. Again, this fits the pattern seen in the solar variation.

Further long period observations of the solar fluctuation should provide invaluable assistance to theoreticians investigating the problems associated with the magnetic variable stars and already the unexplained mechanism by which the two solar fluctuations interact provides an intriguing opportunity for the development of new ideas.

PHYSICS

New Key for Old Lock

from our Solid State Physics Correspondent

THE van der Waals force, first conceived nearly a hundred years ago to explain the behaviour of real gases, has at last been measured directly in an experiment by D. Tabor and R. H. S. Winterton at Cambridge (*Proc. Roy. Soc. A*, **312**, 435; 1969). They used delicate balancing apparatus to bring two-ultra-smooth surfaces of mica to within less than 10 nm of each other, which is close enough for the van der Waals force to act. As well as directly estimating the size of the van der Waals attraction between two surfaces, they have established the somewhat surprising fact that there exists a quite sharp transition between regions where the normal and the retarded van der Waals forces are operative.

The failure of earlier experimenters to bring surfaces closer together than about 100 nm is a fair reflexion of the deftness of technique required of such an experiment. Not only must the surfaces be exceptionally smooth, but comparable precision must be achieved in

both erecting the specimens at their desired separations and in measuring the vacant distance. Tabor and Winterton used a cantilever to balance one of the specimens and they measured the van der Waals force by noting when the stiffness of the cantilever just balanced the attractive force between the two surfaces. The separation of the surfaces was measured by multiple beam interferometry which is claimed to give an accuracy of about 0.3 nm.

The theory of van der Waals forces in solids emerged from confusion about fifteen years ago when Lifshitz put forward an approach which preserved the important distinction between normal and retarded forces but took into account the existence of multiple interactions due to neighbouring atoms or molecules. He considered the zero point energy of electromagnetic radiation in a system of two closely spaced plates. The upshot of his and indeed earlier treatments was that at very small separations the normal van der Waals force would apply and that the retarded force, taking its name from a phase lag, would apply at larger distances. The critical separation was derived from a characteristic wavelength in the absorption spectrum.

Tabor and Winterton made measurements at separations between 5 and 30 nm. They used cantilevers of different stiffness, and found that at a distance of about 15 nm there appeared a distinct change of slope in the curve monitoring the attractive force. At separations greater than 20 nm they found that their results agreed with the predictions of Lifshitz theory for retarded forces. They also managed to extract values for two important parameters in the theory.

What now seems clear is that the distinction between normal and retarded van der Waals forces is quite well defined. In the case of mica, Tabor and Winterton put limits on the transition region of between 10 and 20 nm.

STARS

Astronomical Get-together

from our Astronomy Correspondent

ON October 10 the Royal Astronomical Society held the first ordinary meeting of the session which will see the society's 150th anniversary. Professor Martin Schwarzschild of Princeton University gave the George Darwin lecture, on stellar evolution in globular clusters, and afterwards the action was maintained by an announcement from Professor J. G. Davies of two new pulsars from Jodrell Bank. The meeting was the first to be held in the British Academy, in the opposite corner of Burlington House from the old lecture room of the Royal Astronomical Society which is being converted into a fellows' room and office accommodation. But the move seems not to have alleviated the

TWO NEW PULSARS FROM JODRELL BANK

	<i>JP</i> 2113	<i>JP</i> 2022
Right ascension (1950.0)	21 h 13 m 30 s ± 1 m	20 h 22 m 20 s ± 1 m
Declination (1950.0)	+46° 6' ± 0.1°	+51° 9' ± 0.1°
Galactic longitude	89°	88°
Galactic latitude	-1.3°	+8.4°
Period	1.0147777 s	0.52921 s
Dispersion measure	~100 cm ⁻³ pc	~10 cm ⁻³ pc