astronomy

Support for Brans-Dicke gravitation theory

Two rival theories of gravitation are under consideration by physicists and astronomers. One of these is the general relativity theory of Albert Einstein; the other was derived by Drs. Carl H. Brans of Loyola University and Robert F. Dicke of Princeton University.

The two theories differ radically in their mathematical portrayal of gravity, but their observable physical consequences are so nearly alike that choosing between them is very difficult. Most observational tests have tended to support Einstein, but with such large limits of error that the Brans-Dicke formulation could not be ruled out. Dr. R. A. Sramek of the National Radio Astronomy Observatory now reports one that tends to support Brans and Dicke.

The test involves the prediction, common to both theories, that electromagnetic waves passing near a massive body will be deflected from a straight path. The Brans-Dicke theory predicts 93 percent of the deflection predicted by Einstein.

Dr. Sramek observed the quasar 3C 279 as the sun passed in front of it in October 1970. In ASTROPHYSICAL JOURNAL LETTERS for July 15 he reports a deflection of 90 percent of Einstein's prediction. This offers support for the Brans-Dicke theory, he says, but for statistical reasons it alone cannot rule out Einstein.

Classifying pulsars

A study of the changes in pulse shape and intensity of 20 of the 55 known pulsars leads to the conclusion that pulsars can be divided into three classes. The study, reported in the July 15 ASTROPHYSICAL JOURNAL, was done by Drs. J. H. Taylor and G. R. Huguenin of the University of Massachusetts.

They distinguish pulsars with simple pulse shapes (type S), complex pulse shape (type C) and those that have subpulses that drift in time (type D).

Four of the 20 pulsars are type C, 6 are type D and 10 are type S. With one exception, pulsars with periods less than 0.75 second are of type S. Those with periods greater than that fall into classes C or D, and there is some evidence that those with the longest periods are type C.

Drs. Taylor and Huguenin suggest that the classifications may represent an evolutionary sequence. The rates at which the pulsars are slowing down are taken to indicate their ages. If this is assumed true, then the youngest pulsars are in type S; the oldest in type D. Thus it would appear that pulsars start out with simple pulses and develop complex pulse shapes and/or drifting subpulses as they age. On the other hand, the D pulsars may not be so old as they appear; they may have started with small magnetic fields and thus suffered less spin-down from magnetic breaking.

Periodic fluctuations in Centaurus X-3

The artificial satellite, Uhuru, launched from the platform in the Indian Ocean off Kenya last year, has recorded a number of discoveries in X-ray astronomy. The latest is large periodic fluctuations in the X-ray output of the source called Centaurus X-3. The find is reported in the July 15 ASTROPHYSICAL JOURNAL LETTERS by Drs. Riccardo Giacconi, Herbert Gursky, Edwin M. Kellogg, E. Schreier and H. Tananbaum of American Science & Engineering, Inc.

The intensity fluctuations involved in the periodic pulses are large, corresponding to about 70 percent of the total brightness of the object. The period is about five seconds. Two sudden events also occurred during the period of observation. One was a flare, in which the object's brightness increased by 10 times its previous value in about an hour's time. The other was a decrease and then an increase in pulsation period amounting to about 0.02 and 0.04 percent respectively.

These characteristics are unlike those of radio pulsars, and the observers suggest that the commonly accepted model of radio pulsars—that they are rotating neutron stars—does not fit Cen X-3.

Strange red object in Sagittarius

The *Two-Micron Sky Survey* (also called IRC for infrared catalogue) is a catalogue of celestial objects that radiate infrared light. It was compiled by Drs. Gerry Neugebauer and Robert B. Leighton of California Institute of Technology. Drs. John W. Warner and Robert F. Wing of the Perkins Observatory of Ohio State and Ohio Weslyan Universities have been engaged in checking visible identifications of objects near the galactic center listed in the IRC.

In the July 15 ASTROPHYSICAL JOURNAL LETTERS they report that one of these objects, IRC-20385 in the constellation Sagittarius, corresponds to a large reddish object prominent on Palomar Sky Survey plates taken with a red filter but that disappears on blue-filter plates.

According to Drs. Warner and Wing the best assumption for the location of the object is that it forms part of the Sagittarius arm of the galaxy. They say it bears a striking resemblance to the recently discovered object Maffei 1. Other observers hold that Maffei 1 is an external galaxy (SN: 1/16/71, p. 42), but Drs. Warner and Wing suggest that it may lie in the Perseus arm of the galaxy and be physically similar to IRC-20385.

No deuterium on Venus

The Mariner 5 space probe that flew by Venus carried an experiment to test for atomic hydrogen in the planet's upper atmosphere. It looked for ultraviolet light at 1,216 angstroms wavelength, which atomic hydrogen should absorb from sunlight and reradiate.

Mariner 5 found the ultraviolet but it also found that the density of the Venus atmosphere at that level was two or three times that of ordinary hydrogen. This led to the conclusion that the absorption and reradiation came mainly from deuterum rather than light hydrogen.

To test specifically for deuterium, Dr. L. V. Wallace of Kitt Peak National Observatory flew an experiment on an Aerobee rocket that could distinguish between the radiation from light hydrogen and that from deuterium. There is a slight difference in wavelength, 0.33 angstrom, which Mariner 5 could not resolve. The result, Dr. Wallace writes in the latest KPNO QUARTERLY REPORT, is that the wavelength from light hydrogen appears, but the one from the deuterium does not. He suggests some other explanation will have to be found for the excess density.