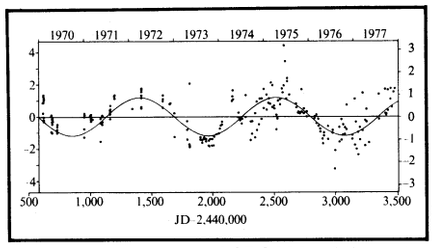
The Plausibility of Pulsar Planets

A number of astronomers have been seeking evidence that stars other than the sun have planets orbiting them. No telescope on earth could resolve the image of a planet belonging to even the nearest star, so the search has concentrated on looking for changes in the motion (or the spectrum) of the star caused by reaction to the orbiting planet. A few claims of such evidence have been made, but they are stridently debated.

Now comes a suggestion that pulsars may have planetary companions, especially the pulsar PSRO329+54. These pulsars have been monitored in a program for the precise timing of pulsar pulses that has been going on for the past ten years. From such information a great deal can be calculated about the dynamics of the pulsar. In one recent case it led to a determination that a binary pulsar is radiating gravitational radiation in the amount predicted by Einstein (SN: 2/24/79, p. 116).

In this case the suggestion about planetary companions is made by M. Demiański and M. Prószyński of the Institute of Physics of Warsaw University. They worked from eight years of data taken at the U.S. National Radio Astronomy Observatory and the Five College Radio Observatory, which were supplied to them by D. J. Helfand.



Cyclic variation in PSRO329+54's pulse count may be due to an orbting planet.

At the basis of the analysis is the now generally accepted model of a pulsar as a compact body (most likely a neutron star) that possesses some kind of radio emitting region in its atmosphere. The rotation of the neutron star carries this region around, and the pulses come every time it crosses our line of sight.

Years of observation show that the pulse rates of pulsars are generally slowing down. To describe this, a "braking index" can be defined as a ratio involving the frequency, the rate of change of the frequency and the rate of change of the rate of change. (The more precise names for these last two terms are the first and second time derivatives of the frequency.)

An expected figure for the braking index can be calculated from the rate at which theoretical astrophysics says a pulsar should lose energy. This number — it equals 3 — requires a very small value for the second time derivative of the frequency. In the Nov. 22 NATURE Demiański and Prószyński point out that, on the contrary, a number of pulsars in the survey show high values of the second derivative. This needs a theoretical explanation. The possibility they want to stress here is the effect of a distant planet with a very long orbital period on the pulsar's rotation. Such a planet might have 100 times the earth's mass and a period of 50 years or so. There are 11 pulsars with anomalously large braking indices for which this could be an explanation.

More curious and perhaps more specific is that in the data for PSRO329+54 a cyclic change with a period of three years appears. This could result from some kind of periodic displacement of the emitting region in the pulsar's atmosphere, but probably the more exciting suggestion is that it is the effect of a small planet, one between 0.06 and 0.57 times the earth's mass orbiting the pulsar every three years. □

The winter reruns

With the recent snowstorms in the eastern Rockies as grim foreshadowing, the Scripps Institution of Oceanography's Climate Research Group issued their prediction this week for the 1979-1980 winter. According to the group's director, Jerome Namias, much of the nation — from the Appalachians to the eastern Rockies — is in for another rough ride. Conditions generally will be mild in the East, however, and near normal in the far West, he says, although most of the nation will be wetter than usual.

Below normal temperatures, combined with above normal precipitation — mostly in the form of snow — will again batter the Midwest, the central and northern Plains and the Rockies, says Namias. Areas east of the Appalachians can expect milder than normal temperatures and heavier than normal precipitation — mostly rain — with occasional cold fronts and few major snowstorms in the Northeast. Temperatures on the West Coast and in Arizona and Nevada will be near normal; precipitation will be heavier than normal except in southern California, Arizona and New Mexico. ("Normal" conditions are those that fall in the middle one-third of the range of observed conditions for an area. They are not necessarily more likely to occur, but include the average, determined over the long term, for a given area.)

Namias attributes the predicted conditions to the pattern of prevailing winds at 10,000 to 40,000 feet. These winds, which usually sweep nearly straight across the country, are expected to form a "bulge", or trough, toward the south that will extend from the western Great Lakes to Texas. The trough will pull cold polar air masses into the central part of the country, but allow mild air masses to move from the Gulf of Mexico and the western Atlantic into the East. Namias includes the effects of the ocean temperatures in his predictions; unusually warm or cold water pools can interact with the atmosphere to force abnormal seasonal patterns.