The gravitational radiation would carry a great deal of energy from the system, causing the two stars to grow closer together. As they got closer their rotation period would change. This would change the frequency of the radio pulses, an effect that is not observed.

To save the situation they propose that orbits of the binary stars should be gravitationally quantized as the orbits of electrons in atoms are electromagnetically quantized. A series of discrete stable orbits would be allowed, and when they were in these orbits they would not radiate gravitationally.

A similar idea saved atomic theory at a time when classical electromagnetism predicted that electrons revolving around nuclei would radiate electromagnetic energy the same way as the binaries are supposed to radiate gravitational energy; this would cause the atoms to collapse. Atoms manifestly do not collapse, and the quantum theory was invented to explain why.

Quantization of gravitational effects is accepted by modern theory, but the quanta are supposed to be so small that their effect on systems like binary stars cannot be observed. What Dr. Saslaw and his colleagues propose is to change the basic theoretical size of the quantization so that it should show up in such systems.

Another theory of the pulsating sources—this one appears in the same issue of NATURE and is by Dr. Jeremiah Ostriker of Princeton University—uses only one star to get the pulsating effect; the one star is a white dwarf.

Other white dwarf theories assume that the whole star pulses and the pulsations in radiation output come from pulses of the star's mass. Dr. Ostriker suggests that the white dwarf doesn't pulse at all. Instead it has a radio bright spot—like a sunspot or something similar—that is carried around by rotation of the star. Earth-based telescopes receive bursts of radiation when this spot points at us each time around.

Dr. Frank Drake, director of the Arecibo Ionospheric Observatory in Puerto Rico, doesn't really believe any of it.

His data, he said last week at the American Geophysical Union Meeting in Washington, is strongly against such pulsar explanations as intelligent civilization, rotating stars or binary stars and "completely kills gravitational focusing."

He has no pet model of his own, but will hold still for a pulsating object of any type, including a neutron star or white dwarf. At least one member of the present Cornell group, however, Dr. Thomas Gold, is holding out for a rotating neutron star, with a sunspot like Dr. Ostriker's dwarf. ◇

BLACKOUTS

Human error; slow construction

Electric power is such an integral part of American life, that, to keep the nation functioning, the supply must be reliable. Two incidents in recent years have shown that it isn't, and that local breakdowns can black out large areas.

Last week the Federal Power Commission reported on the latest of the major blackouts, which pulled out the plug in large parts of Pennsylvania and New Jersey and parts of Maryland and Delaware on June 5, 1967. The cause: human error, compounded by systems inadequate to carry extra loads and protect against emergencies.

The June failure started when too much power was inadvertently switched into a high-power 230 kilovolt line between Nottingham and Plymouth Meeting, Pa., carrying power from the Conowingo plant. The overload on the line caused it to heat and sag; at one point it shorted on a nearby low power-line.

When the line shut down, power from four big generators at Muddy Run had nowhere to go. Ironically, the four-state system was on the point of hooking in a 500-kilovolt transmission line which had been delayed in construction past its scheduled 1966 completion. The Muddy Run plant was only temporarily on the Nottingham line, but when that line closed, the plant was automatically shut down.

At this point, the disadvantages of big, interconnected power systems suddenly outweighed the advantages.

Two economic factors have led American power companies to band together in these big regional service areas. Since peak demands vary from time to time and place to place, a station not marketing its full power locally at any one time can send it along to another area that has a big demand. Interconnected systems also allow companies to build very large generating plants, which are more economical than smaller units. In addition, a failure in one area can be, and often is, replaced by another station without any loss of service.

When increased power is demanded from a station, its generating turbines slow down, and the frequency drops from 60 cycles per second. This can be corrected by stoking the furnace a bit (or increasing the water flow in a hydroelectric plant).

But if the drop is too much or too sudden, it can damage or destroy the generator. In that case, safety devices shut the plant down first.

When the Nottingham-Plymouth Meeting line went out, it put a strain on a system that was already operating close to the edge of collapse. Incomplete transmission lines designed to take the load off the Nottingham line, were paralleled by unfinished generating units, totalling 2,440 megawatts.

As a result, some power stations connected to the pool started disconnecting automatically to keep from being shut down by excess demand. An isolated area, including Philadelphia and Newark, suddenly had to depend on its own generating capacity alone; the demand was too great, and within eight minutes of the first disturbance, the whole area was shut down.

Startup of the system was made fairly easy since the generators which had cut loose from the pool remained in operation and were available to provide priming power to get the knocked-out turbines turning again. But disturbingly, a second switching error caused another cascade of failures two hours after the first one. Bringing restored power into the blackout area too fast, operators put too much power into a smaller line, which sagged into a tree and shorted out.

Service was finally restored completely by 8 p.m., 10 hours after the first breakdown.

Although the 1967 blackout was not as serious as the one that plunged New York, New England and Ontario into darkness in November 1965, the FPC's comments and recommendations were disquietingly similar in both cases. The earlier blackout, caused by a defective relay that incorrectly switched a big surge of current from one transmission line to another, wouldn't have happened if adequate facilities had been available.

If, instead of shutting down, generating plants could simply douse the lights in part of the system, the pool of interconnected generators wouldn't be knocked out of operation like a row of dominos. Once the emergency is over—a few minutes, usually—the partial blackout could be lifted quickly, without having to start up the turbines again. The trouble is that the domino effect takes place so fast that manual load dumping may not be possible.

The commission recommended in 1965, and repeated its recommendation last week, that automatic load dumping systems be installed. That recommendation, it reports, is being carried out, but installation is a fairly lengthy process.