

letters

Quasiperiodic pulsars

A recent Search and Discovery report on quasiperiodic oscillations from x-ray sources (October, page 17) stated, "Observations of isolated pulsars show that neutron-star magnetic fields decay in just a few million years." This idea has proven quite attractive to many astrophysicists, but it is far from being an established fact. Indeed, it stems mainly from the observation that there are few pulsars with periods longer than three seconds. Because pulsars are all slowing down, one would otherwise expect an accumulation of slow pulsars, and it was suggested early on that these slow pulsars fade from view owing to decay of their magnetic fields (as is discussed, for example, in the monograph *Pulsars* by R. N. Manchester and J. H. Taylor).

Since those early days, a number of alternative mechanisms have been identified that would also explain the lack of long-period pulsars. For example, the surface temperature of a neutron star is estimated to fall precipitously after a few million years, to name just one factor having essentially the same characteristic time. It should be emphasized that the radio emissions account for only about 10^{-5} of the apparent power output as judged from this slowing down. Thus turning off the radio emission would not necessarily change the slowing-down rate at all.

The pulsar data are very scattered; there is nothing like a "main sequence" for these objects. Indeed it is widely thought that the slowing-down torques scale essentially as the period to the fourth power, but it has not been possible to establish this exponent clearly in the data. It is curious, then, that so much confidence is invested in the detection of a first-order correction to the slowing down (magnetic-field decay) when the zeroth-order slowing down itself cannot be accurately calibrated. This rapid drop in luminosity gives a characteristic age of a few million years and a limiting period of a few seconds simply because the pulsars become too faint to be seen. Thus observational selection becomes important as well.

Theoretical estimates of the neutron-star conductivity have systematically

given values too high to give such a rapid decay, except possibly in the outermost crust. The core is even thought to be superconducting.

The binary pulsating x-ray sources are thought to be old neutron stars accreting from a binary companion, yet some show line spectra suggestive of cyclotron emission in strong pulsarlike magnetic fields. The one independent observational test so far fails.

The idea that a celestial body is magnetized by flux trapping at its formation, with subsequent ohmic decay, does not work anywhere that it can be tested. It is obviously incorrect for the Earth and the Sun. To the modest degree that planetary magnetism is understood, one would even expect rotating neutron stars with superfluid cores to be generators of magnetic fields, not sinks.

It would be very important if the idea about magnetic field decay were correct because, as the article goes on to illustrate, that idea is highly constraining on evolutionary scenarios for many astrophysical objects. Gamma-ray-burst sources may also be old neutron stars, for example. Until there are reasons to be more confident in this idea, it would appear sensible to present it carefully for what it is: an idea and not an established fact.

F. CURTIS MICHEL
Rice University
Houston, Texas

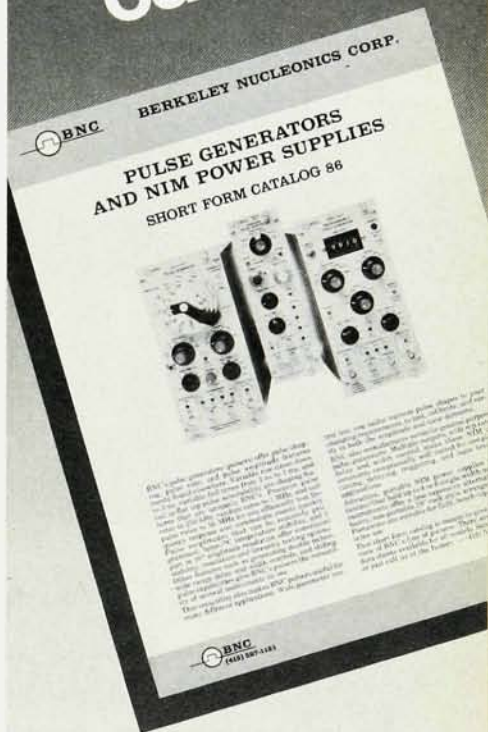
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Rename Livermore

Your news item, "California Regents will renew contracts for labs" (January, page 81) prompts me to bring a relevant issue to your readers' attention: Should not the name of Ernest O. Lawrence be removed from the title of the Livermore National Laboratory? As Lawrence's widow, I have felt for some years that this government-owned facility should no longer be using his name. My reasons are moral, historical and practical.

First, I am unalterably opposed to the continuing escalation of the nuclear-arms race, and because this is now the primary activity of the Livermore laboratory—both in terms of the research conducted there and of lobby-

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