

A Pair of Planets at a Pulsar's Periphery

In their very interesting and up-to-date article "The Search for Forming Planetary Systems" (April, page 22) Anneila I. Sargent and Steven V. W. Beckwith neglected to mention that the first extrasolar planetary system has already been discovered, by Aleksander Wolszczan and Dale A. Frail.¹ Two planets, each only a few times more massive than Earth, are orbiting a millisecond radio pulsar (a neutron star), PSR 1257+12, with orbital periods of about two and three months, respectively. This is certainly not a traditional environment in which planets were expected, but it strongly supports the notion that planets are easy to form, and it makes the case for the continued search only stronger. The planetary system found around PSR 1257+12 was discussed at many meetings, and it was the main topic of a conference at Caltech² in the spring of 1992. The precision of the pulsar timing data is very impressive: The amplitudes of the pulsar radial velocity change due to the two planets are approximately 43 cm/sec and 31 cm/sec, respectively, and these amplitudes are measured with an accuracy of a few millimeters per second. This high precision should make it possible to verify a theoretical prediction,³ namely that very small perturbations in the planetary motion are expected from the mutual gravitational perturbations of the two planets.

Careful studies of such Earth-like planets, including their mutual gravitational perturbations, are not accessible to any of the techniques described in Sargent and Beckwith's article, at least not in the foreseeable future.

References

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SARGENT REPLIES: Bohdan Paczyński is correct in pointing out that in our article Steven Beckwith and I neglected to mention recent detections of planet-like objects around pulsars. I was a member of the organizing committee for the Caltech meeting to which he refers and am very aware of progress in this field. However, in writing for an audience as wide as the readership of *PHYSICS TODAY*, one is often forced to streamline one's approach. As a result, we confined ourselves largely to the question of observing planetary systems in formation. Fully developed objects orbiting pulsars were technically outside the scope of our review. And, of course, our mind-set was perhaps biased toward forming planetary systems that might eventually support life as we know it. It was certainly not our intention to denigrate pulsar-planet work by omitting all reference to it. We are delighted that Paczyński has drawn attention to this fascinating and related topic and provided references for readers who may wish to pursue it.

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7/93

Surface Screening: No Superficial Matter

I read Marc A. Kastner's well-written *PHYSICS TODAY* article on artificial atoms (January 1993, page 24) with much interest. One reason is that Kastner had the unenviable task of describing, without mathematics, surface screening by electrons in metals, where quantum and classical concepts sometimes come into conflict and one must give priority to one or the other, as appropriate.

There were at least two possible pitfalls. The first was on page 27, in dealing with the Coulomb blockade energy for a small particle, where the choice of an inappropriate phrase could have suggested to the reader that the electron interacts with itself. Kastner carefully avoided this trap by ascribing this term to "the repulsive interaction between the bits of charge on the particle."

The second was on page 28, where, in describing the "all-metal atom," Kastner writes, "The high density of electrons also results in a short screening length for external electric fields, so electrons added to the atom reside on its surface." This statement would, of course, be correct on replacement of "electrons added" by "electric charge added." However, as it stands it is a correct statement *only* if the added electrons go into surface states (or, speaking quantum chemically, surface orbitals), which (I assume) Kastner did not intend.

The point is that in the absence of surface states, the added electrons go into bulk states, just like all the other conduction electrons.

That leaves an apparent conflict with the classical notion (certainly applicable to artificial atoms) that excess charge goes to the surface of a conductor. The resolution is that all the electronic states make slight adjustments outward, enabling the bulk to remain neutral and leaving the excess charge (due to the sea of conduction electrons) to reside on the surface.

I make this comment as an extrapolation from having studied the related problem of screening at a metal surface,¹ where the wavefunctions of all the conduction band electrons are self-consistently perturbed by the presence of an external electric field. Only well after the calculations were completed and the work was published did I recognize the conceptual implications that quantum mechanics (actually, wave mechanics) has for our physical picture of ordinary electrostatic screening.

Children see illustrations of electricity with minus signs on conducting surfaces, which they are taught

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represent actual electrons that are attracted to the surface by a positively charged rod. Adult physics students, even after learning quantum mechanics, do not have this misconception corrected. Nevertheless, using only the concept of the electron orbital and the Pauli principle, it is possible to give a correct qualitative description of surface screening by electrons in metals.

Reference

1. V. E. Kenner, R. E. Allen, W. M. Saslow, *Phys. Lett. A* **38**, 255 (1971).

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What Really Keeps Women from Physics?

As a physicist with more than 20 years' experience who was recently forced to leave the United States to obtain emotionally satisfying employment, I find the article "Women in Physics: Reversing the Exclusion," by Mary Fehrs and Roman Czujko (August 1992, page 38), extremely disturbing, on several distinct levels.

First of all (and this is a relatively minor point), why, at a time when thousands of existing physicists and engineers are unemployed or underemployed, should we be shooting ourselves in the foot by encouraging *any* newcomers to enter the profession? The supply of physicists and engineers in the US far exceeds the demand, and anybody who enters these fields in the foreseeable future will simply displace someone else.

Second (and this is much more important), aside from our own selfish interest, isn't it morally reprehensible to seduce innocent young girls (or anybody else, for that matter) into a profession where *all* the practitioners—male *and* female—are treated like \$#!*, a field that always has been and always will be overpopulated, underpaid and underappreciated?

According to Fehrs and Czujko there is a malevolent conspiracy on the part of "the physics community and society at large to exclude women from physics." The weapons used in this insidious campaign include "sexist jokes," "social overattention" and (horror of horrors!) "total reliance on male pronouns." If a person who sincerely wants to be a physicist can't stick to her guns in the face of male pronouns, how will she cope with the *real* flak that gets thrown at all of us during our careers?

On yet a third level, it is very disturbing to see the pages of PHYSICS

TODAY being used to spread "politically correct" thinking and tired old feminist rhetoric. This is ironic, because the real problem for physicists and engineers, male and female, in the US is not "sexism" (whatever that is); it is anti-intellectualism. In fact, Fehrs and Czujko come very close to the truth but then shy away from it when they grudgingly admit that "for whatever reason, women react more strongly to both positive and negative comments than do men." Precisely! And it is not socially acceptable in the US to be a physicist or engineer. The huge imbalance between the number of male and female physicists is simply a reflection of the fact that boys and men are more willing than girls and women to do things that society disapproves of. And why are physicists so despised? Because we have a reputation for being able to think clearly, for being cold and logical, for being unswayed by emotion. It doesn't matter whether we actually fit this stereotype; what matters is that society perceives us as being capable of thought, and to quote from Bertrand Russell, "People fear thought more than they fear anything else on earth—more than ruin, more even than death."

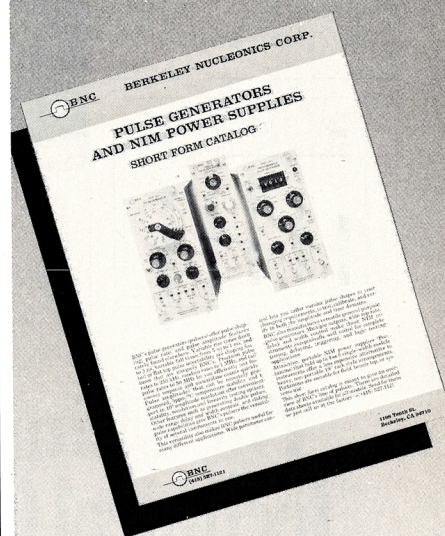
Fehrs and Czujko gloss over the increasing participation of foreign women in American universities. Obviously, outside the US, it is still socially acceptable to be intelligent, to be highly educated, to worship knowledge and to respect learned people. A foreign woman with a PhD in physics from an American university can go back home and become a respected leader, even if she happens to be from a society with very strong ideas about traditional gender roles.

As a final example of the way in which Fehrs and Czujko consistently overlook the obvious in favor of political correctness, consider their statement that over 5000 American women got medical degrees in the US in 1990 compared with 63 in physics and that physics is thus "not get[ting] its share." They raise the absurd rhetorical objection that "one would be hard-pressed to argue that physics calls for 80 times as much . . . commitment as medicine." Of course not! The point is that medicine is, apparently, 80 times more rewarding than physics and 80 times more socially acceptable. Americans are obsessed with physical health; therefore physicians ("real doctors") are seen by the public as gods and goddesses.

Fehrs and Czujko paint an overly optimistic picture of life as a physicist, so overly optimistic that it borders on lying to young people. Any-

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