letters

or (B) *have received their doctorates, have had their careers interrupted, and are re-entering the work force within five years after such interruption . . .*" (my emphasis).

The NSF Authorization Act *does* respond to women scientists in mid-career. My disagreement with it stems from its lack of support for women seeking the PhD. In that area it makes vague attitudinal commitments, as opposed to monetary ones.

Unfortunately, this whole issue may now be moot, considering Mr. Stockman's proposed and, I think, now effective removal of the "Women in Science" part of the Act as part of Mr. Reagan's program to trim the budget.

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THE AUTHOR COMMENTS: If the NSF would interpret "women scientists with careers interrupted" to include women who have been working for the past six years in temporary, year-to-year positions such as research associate or non-tenure-track faculty, then I would withdraw my complaint. There are just too many mid-career female scientists in such anomalous positions, and these women are being discriminated against by Public Law 96-516. If the National Research Opportunity Grants are reinstated, I hope that the present restrictions are removed and the grants are made available to all women scientists in untenured positions, with preference given to women who are at least six years past the PhD. Recent PhDs in post-doctoral positions don't need additional grants.

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Theory or force?

In the abstract of their article, "Unified Theory of Elementary-Particle Forces" (September, page 30) Howard Georgi and Sheldon Glashow claim that the weak, electromagnetic and strong interactions appear to be "no more than different components of the same fundamental force." I should like to ask the authors, however, if what they are dealing with is a *unified theory* of (several) forces or a theory of (a single) *unified force*?

The distinction seems to me to be crucial. Up to the present time a force was "fundamental" if it had a unique (set of) source(s): mass (of one sort only), charge (of 2 types, + and −), color (3 kinds), and so on, and a unique carrier(s); graviton, photon, and so on, by which energy and momentum was transported across space. In this context Georgi and Glashow have a unified

theory of 3 (or more?) forces, but do not have a unified field theory in the sense intended by Einstein, for instance.

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THE AUTHORS COMMENT: It would be rather odd to say that there are eight strong forces just because QCD involves eight gluons. It makes more sense, it seems to us, to say that there is one strong force. Only the entire set of eight gluons shows the full SU(3) symmetry.

In the same way, if the SU(5) symmetry of a unified theory were not spontaneously broken, everyone should agree that the SU(5) theory describes a single force. Thus, at high temperatures or short distances SU(5) is "a theory of a single unified force."

Of course, the structure of the vacuum fragments the SU(5) force into the various interactions we see at accessible distances and temperatures. What you choose to call this spontaneously broken theory is up to you. We are less interested in these semantic distinctions than in the substantive question of whether or not the theory is right. If proton decay is observed at the predicted rate, there will be a strong presumption that SU(5), or some similar unified theory, is a more complete description of the world than the separate theories of strong and electroweak interactions.

On a completely different subject, we take this opportunity to make two additions to the list of contributors to the idea of baryon number generation in the early universe. Tony Zee (now of the University of Washington) was inadvertently omitted from the group of Princeton physicists who were among the first to develop a completely consistent scenario for baryon number generation in the context of unified theories. In the 1960s, well before the QCD and the electroweak theory were formulated (let alone unified theories), the great Russian physicist Andrei Sakharov pointed out that the baryon supplies in the universe could be explained if protons were unstable.

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Corrections

April, page 56—the table lists incorrect values for basic energy sciences in the Department of Energy's FY 1980 and 1981 budgets. The total basic energy sciences budget in 1980 was $225.0 million, and the total this year will be $239.5 million.

April, page 80—P. J. E. Peebles is a professor of physics, not astronomy, at Princeton University. □