A CONDENSED FUNDING MATTER AT NSF

The discoveries in high-temperature superconductivity during the past two years are widely recognized as revolutionary breakthroughs in terms of both basic science and long-term technological promise, and it was generally expected that in response to these breakthroughs NSF would increase its support for basic research in superconductivity. In the current fiscal year, however, most continuing grants in the Condensed Matter Sciences Section of NSF's Division of Materials Research were supported at levels significantly below their original commitments from NSF. The Condensed Matter Sciences Section, which consists of the Solid State Physics, Low Temperature Physics, Solid State Chemistry and Condensed Matter Theory Programs, provides virtually all of NSF's support for single-investigator research on the basic science of superconductivity.

In an official "Statement on Funding Levels for the Division of Materials Research" dated 3 March 1988, Richard Nicholson, NSF's assistant director for mathematical and physical sciences, attempted to justify these reductions as resulting from overcommitments incurred by program directors during the previous fiscal year. Although Nicholson acknowledged that "the [NSF] research budget has shown no real growth since 1985," his statement conspicuously fails to address the crucial issues of NSF's priorities in distributing its available resources during the past four years, and of NSF's failure to respond to breakthroughs in superconductivity. I write to focus attention on the latter issues, which are of vital concern to the condensed matter physics community.

Discussion of these issues must begin from NSF's budget allocations during the period in question; the relevant budget figures are summarized below. I extracted these figures from NSF's published budget summaries, and believe that they are correct to within a few tenths of a percent. Between fiscal years 1985 and 1988, the NSF budget for Research and Related Activities rose by 10.9% and the budget of the Mathematical and Physical Sciences Directorate increased by 8.1% (including only those divisions that remained in the directorate throughout this period). Within the Division of Materials Research, the Metallurgy, Polymers and Ceramics Section's budget grew by 5.2%, that of the Condensed Matter Sciences Section by 4.0%, and that of the Special Programs Section (comprising the Materials Research Laboratories, Materials Research Groups, National Facilities and Instrumentation Programs) by 2.6%. Approximately half of the Special Programs budget goes to support research in condensed matter sciences.

The figures for 1987 and 1988 follow a similar pattern: The NSF budget for Research and Related Activities rose by 3% and the budget of the Mathematical and Physical Sciences Directorate increased by 1.8%, while within DMR the increases were 7.4% for Metallurgy, Polymers and Ceramics, 0.5% for Condensed Matter Sciences and 0.2% for Special Programs. (The Special Programs Section was also forced to reduce a number of continuing grants below their committed levels in 1988.) While these figures are consistent with Nicholson's statement that the total NSF research budget has not grown in constant dollars since 1985, they also show unambiguously that the constant-dollar budgets for Condensed Matter Sciences and for Special Programs have decreased significantly since 1985. In 1988 NSF's response to the revolution in superconductivity was effectively negative in real dollars for basic science.

These funding cuts occurred during a period of exceptional intellectual vitality and growth in condensed matter physics, and they raise fundamental questions about the ability of the

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National Science Foundation to establish and implement appropriate priorities. The decision to "increase" funding for the Condensed Matter Sciences Section by 0.5% and for the Special Programs Section by 0.2% in fiscal year 1988, the first new budget year since the discovery of high-temperature superconductivity, appears particularly inexplicable; the 7.4% increase for the more engineering-oriented section of DMR demonstrates that even in a year of tight budgets, funds could be found for projects of priority to the NSF management. While part of this increase may have gone for research in processing of superconducting materials, the budget of the Polymers Program also increased by 14.2% from 1987 to 1988. Equally perplexing is the essentially flat funding (before inflation) of the Special Programs Section at a time when NSF management has presented centers as a major new initiative.

In the face of these substantial reductions in real dollars for condensed matter science, the issue was not whether cuts would be required, but only when and how the cuts would be carried out. Perhaps NSF's senior management would have preferred a policy of more gradual attrition that attracted less attention from the community. Instead of making scapegoats of rotating program directors who struggled to maintain the condensed matter sciences under extraordinarily difficult circumstances not of their own making, the senior management at NSF should analyze the policies or oversights responsible for the substantial cuts in real funding for condensed matter science over the past four years, and should explain why the foundation has failed to respond in a positive way to the revolutionary scientific developments in high-temperature superconductivity.

NSF's priorities, as reflected in practice through its patterns of budgetary allocations, are a legitimate matter of public concern. Individuals and groups interested in the future of condensed matter physics should urge that NSF remedy its disregard, in practice, for condensed matter science.

JOSEPH W. SERENE
4/88 *Washington, DC*

NICHOLSON REPLIES: Joseph Serene's letter refers to the reductions in outyear commitments in condensed matter sciences discussed in the April PHYSICS TODAY (page 61). In that report I am correctly quoted as stating that the reductions were made necessary because overly optimistic budget projections led some program officers to make commitments that could not be sustained, and that this situation should not have been allowed to develop.

I believe it would have been appropriate for Serene to have noted that during the worst period of overoptimism in 1987, he was the section head for Condensed Matter Sciences at NSF and thus bears significant responsibility for the decisions that were made. The current section head and rotating program officers, who have had to deal with the effects of those decisions, had no part in their making. It was certainly not my intention to make "scapegoats" of them.

RICHARD S. NICHOLSON
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Inflation Anti-Defamation

In the news story "Large-Scale Structure, Streaming and Galaxy Formation" (October 1987, page 19), it is claimed that "models based on the inflationary paradigm are . . . severely strained by . . . recent observations." The main arguments, according to the quoted remarks of Richard Bond, are that "it is difficult to make a scale-invariant spectrum [produced by inflation] work with large-scale streaming" and that if Neta Bahcall's results (on the two-point correlation function $\xi(r)$ at separations r on the order of 50–100 megaparsecs) are correct, "then they are completely inconsistent . . . with *any* plausible theory based on the inflationary paradigm for density fluctuations." It is claimed also that the situation could be improved with a spectrum of fluctuations growing on large scales or with non-Gaussian fluctuations. But James Peebles is quoted as saying, "Within inflation, no one has come up with a source for non-Gaussian fluctuations."

We would like to note that within inflation it is quite possible to obtain spectra of fluctuations of almost arbitrary shape[1,2] as well as non-Gaussian fluctuations.[1–3] It is possible also to obtain exponentially large domains with a different density of matter inside each,[2,4] or with almost equal total densities but different densities of baryons, or with the same density of all particles but a different spectrum of fluctuations inside each.[2,5] Thus the inflationary paradigm is much more flexible than is sometimes believed.

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