How Broadly to Take Temperature?

Charles Kittel's Opinion piece (May 1988, page 93) disputing the concept of fluctuating temperature also questions any use of the concept of temperature in describing the behavior of small systems. His general point of view seems to me quite reasonable, but a conclusion about what to call "small" requires some knowledge of the actual systems in question.

Let us agree to limit the use of temperature to systems possessing an energy reservoir that can be shared statistically, and also possessing a smooth density of states whose logarithm varies linearly with excitation energy over a substantial range. These conditions appear to be satisfied for heavy nuclei excited to several tens of MeV of energy, even though they contain a small number of particles. For example, at an excitation of 50 MeV there should be about 10^{28} levels per MeV in a nucleus of mass number 200, and the density should increase by a factor of e for an increase of 1 MeV, roughly, in excitation energy. How do we make a heat reservoir? When the nucleus emits a neutron, its energy distribution is determined by the density of daughter states. In effect, the nucleus exchanges energy statistically with the freed neutron. The neutron energy spectrum then falls off with the factor e for each MeV increase in energy. Empirically, behavior like this is observed over several decades of the probability distribution. Dare we call this a Boltzmann factor with a temperature $T = 1$ MeV? The reader must judge for himself.

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/88

Life Styles of the Rich (and Physicists)

One of the most important issues relating to the strength of our scientific establishment is that of quality of life. I feel that this issue, more than the quality of high school science instruction, is responsible for the current state of technology in our country.

While success in law, business and medicine is often measured in six figures, pay levels in skilled labor jobs often equal the salaries paid scientists and engineers. Today, it is not uncommon to find carpenters, plumbers or electricians whose average yearly pay is in the \$40 000–\$50 000 range. *R&D* magazine in its yearly poll of over 1900 readers found that the average scientist or engineer with 17 years of experience and a master's degree earns between \$45 000 and \$50 000.

Salary is but one facet in the quality-of-life debate. The educational establishment often forces a prospective physicist into a monastic life of poverty, chastity and obedience. This begins in the undergraduate program, where the science and math requirements leave little time for the student to educate him- or herself about the rest of the world. Lack of education in other areas limits career growth as well as contributes to the image of the physicist as a one-dimensional intellectual.

For most physicists, graduate school represents a financial as well as an intellectual challenge. It is not uncommon for students to postpone marriage and starting a family while in graduate school, especially if the prospective spouse does not work. Often, little guidance is offered to a student about permanent job propects in his or her thesis concentration area. We all know of areas in physics that offer only postdoc-type positions. The time it takes to complete a doctorate in physics is longer than in related fields like mathematics and engineering. Is this due to academic rigor or to the lack of graduate students?

A number of graduate departments, through misguided policies, actually increase the difficulty of graduate life. The qualifying examination process often can be dragged out over two years or longer. If a student receives an additional research scholarship or grant from an outside organization, the student is often limited in what additional funds he or she may receive from the department. Joint programs, where a

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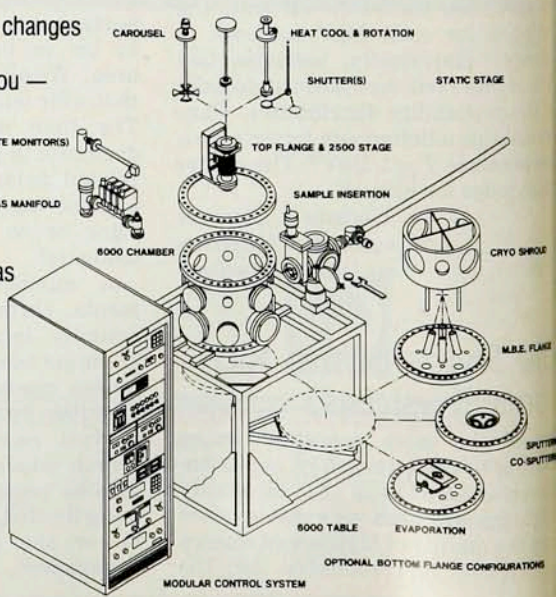

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student works in private industry or government while attending graduate school, are rare and often are discouraged by the department or the employer.

Graduation usually improves finances, yet physicists must now face a new array of problems. Unstable business and government policies have contributed to the image of the scientist or engineer as the "migrant worker" of the professional field. Proprietary employment agreements place severe restrictions on the mobility of technical workers. A number of companies with strong research images are now "pimping" their technical staffs for government contracts at $180 000 per man-year rather than using these staffs to create new products and jobs. Most of these policies are aimed at fostering short-term corporate profitability rather than at improving our industrial and scientific position with respect to the rest of the world.

Unlike the Institute of Electrical and Electronics Engineers, the American Bar Association or the American Medical Association, The American Physical Society has long been dormant in trying to improve the quality of its members' lives. Too often the society has promoted physics rather than physicists. This, I believe, has led to the large decrease in the number of American graduate students and the subsequent decline in American technological preeminence.

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5/88

THE EXECUTIVE SECRETARY OF APS REPLIES: The American Physical Society exists to "advance and diffuse the knowledge of physics" and has carried out that purpose primarily by publishing journals and holding meetings. Since the 1970s, however, APS has recognized that providing support for the education, training and careers of physicists is a necessary and appropriate aspect of its mission. APS and the American Institute of Physics have undertaken several low-key activities useful to physics graduate students and to physicists seeking employment.

AIP's education and employment statistics division obtains and provides data on graduate programs and on physics as a profession, and regularly reports the findings. Working with this AIP division, the APS committee on opportunities recently completed a survey of physics department chairs. Data have been extracted from the survey's results on the availability of both jobs and candidates in the subfields of physics. A report on the survey will appear in a future issue of the *Bulletin of The American Physical Society*. AIP's career placement service, which is available to APS members free of charge at meetings and at AIP's New York headquarters, offers job listings, arranges interviews and provides individual counseling.

Efforts on behalf of women and minorities in physics, prizes and scholarships, and the matching membership program are other examples of what APS does for individual physicists.

Unlike APS, organizations such as IEEE and the AMA have the same tax status as a trade union (501-C6 status). Because they exist primarily for the benefit of their members, these organizations can provide "quality of life" services that APS is not permitted to offer and for which APS does not have the resources. The APS council has periodically considered and debated the benefits to physics and physicists of changing its IRS status, but has always overwhelmingly rejected such a move. Among the effects of such a change would be a sizable increase in APS membership dues, because tax-free status would be forfeited and more income would be needed to support existing services. APS values its identity as a public-interest organization, and expects to continue in its role as a promoter of physics.

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11/88

Where the Academic Elite Meet to Inbreed

On 26 October 1987, *US News and World Report* published a list of the top colleges and universities in the United States.[1] This ranking of the so-called "best" created a mild furor in academic circles.[2] Once again the issue of the validity of ranking faculty, academic programs, and colleges and universities emerged.

In the November 1983 edition of *Changing Times* a listing of the most highly regarded doctoral programs in 32 academic disciplines was presented.[3] These rankings were based on a five-volume study published by the National Academy Press.[4] Entitled "An Assessment of Research-Doctorate Programs in the United States," this study reviewed 2700 PhD programs in 32 disciplines ranging from anthropology to zoology.

In the ratings reported by *Changing Times* two key measures of repu-

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