Confinement Predictions for ITER

We take issue with the way James Glanz's article of 6 December about plasma turbulence and ITER (International Thermonuclear Experimental Reactor) performance (News & Comment, p. 1600) represents the significance of the predictions of a particular turbulent transport model relative to confinement projections for ITER.

Projections of ITER confinement performance are based at present primarily on extrapolations of a large body of experimental data. This methodology for confinement projection has been reviewed and endorsed by an international working group of experts on the subject and by the ITER Technical Advisory Committee—an international group of senior plasma physicists and fusion engineers. We agree with the conclusions of both of these groups that extrapolating experimental data provides at present the most reliable basis for projecting ITER confinement.

Present theoretical transport models are not yet complete, nor are they sufficiently validated for predicting ITER performance. Nonetheless, theoretical confinement projections for ITER, based on several different transport models, bracket the projections obtained from the experimental data, thus increasing confidence in the latter. The ITER team and associated expert groups are developing and validating improved projection methods, including both experimental extrapolation and theoretical models, and these efforts should lead to improved confidence in confinement projections.

Such recent theoretical advances as the work highlighted in Glanz's article, combined with recent experimental advances in tokamak operation, including those in which turbulent transport is suppressed, represent exciting progress in understanding the fundamental physics of tokamaks.

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*On behalf of the members of the ITER Steering Committee–U.S., the independent U.S. technical advisory committee on ITER composed of the following senior representatives from a broad range of institutions within the U.S. fusion program: W. M. Stacey, chair (Georgia Institute of Technology); R. D. Hazeltine (University of Texas); M. Porkolab (Massachusetts Institute of Technology); D. M. Meade (Princeton Plasma Physics Laboratory); M. J. Saltmarsh (Oak Ridge National Laboratory); R. E. Siemon (Los Alamos National Laboratory); T. Simeonen (General Atomics); D. L. Smith (Argonne National Laboratory); D. Steiner (Renssalear Polytechnic Institute); K. I. Thomassen (Lawrence Livermore National Laboratory); and M. A. Ulrickson (Sandia Laboratories).

The grand vision of the ITER experiment may be colliding with technical, as well as physical, reality. Less discussed outside the fusion community are, for example, the still unresolved structural integrity problems of the components facing or close to the plasma. Electromagnetic and thermal loadings associated with abnormal plasma behavior (for example, disruptions and runaway electrons) may damage components so severely that a definitive reactor shutdown is required after the first event. Even under normal operational conditions, the structural viability of all the high-heat flux components has not been demonstrated.

The current ITER project is the last part of the approximately 18-year-old effort to develop a tokamak "next-step" device. This effort has excelled in terms of unprecedented international cooperation and also in terms of its unprecedented, unfavorable cost-to-progress ratio. Almost $1.5 billion has been globally swallowed since the inception of the International Tokamak Reactor project in 1978 (with the United States, Europe, Japan, and the former Soviet Union collaborating), but attempts to solve the integrity problems and numerous other problems in most of the engineering and technology areas have resulted in cyclic design iterations that have scarcely gone beyond the conceptual, or preliminary, stage.

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Surfing the Neuroscience Net

"Surfing the Net" can be confusing if one does not know what to look for or where to look. The recent article by Floyd E. Bloom (15 Nov., p. 1104) will be helpful to neuroscientists and provides information for anyone with specific or general questions about neuroscience.

For researchers interested in neurodegenerative diseases, the catalog of sites at http://www.sciweb.com/directories.html can be useful. This site provides a list of World Wide Web sites on many subjects, including a disease-associated site at http://www.sciweb.com/dir_disease.html. This site has listings of other sites on various diseases, including Alzheimer's, at http://med-amsa.bu.edu/Alzheimer/home.html. One site at http://med-amsa.bu.edu/Alzheimer/neurodis.htm has listings for other neurodegenerative diseases, including Parkinson's, Huntington's, and multiple sclerosis.

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Bloom's superb article omitted one Web site that allows full-text searching on a database of more than 110,000 Web pages, all of which have been prequalified as relevant to neuroscience. The site allows easy access to an estimated 5000 megabytes of actual Web page content, including text, images, and movies. English and several foreign languages can be used, or a special query syntax can be employed by those wishing to master it.

The URL for this site is http://www.acsiom.org/nsr/neuro.html. The service is free, noncommercial, and open to all. The only request is that users limit the total number of URLs requested for any single query to 200. There is no limit on the total number of different queries one may submit.

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In Focus

The Perspective "The imaging of individual atoms" by David A. Jefferson (18 Oct., p. 369) does an excellent job of helping the reader appreciate the work of P. D. Nellist and S. J. Pennycook (Reports, 18 Oct., p. 413) in advancing atomic resolution microscopy. Jefferson correctly points out that, while x-rays and neutrons have contributed to atomic resolution structure studies of crystals, they have not done so when it comes to single individual atoms. But his statement that "no lens is available for either x-rays or neutrons" misses an active and growing area of research. On the basis of pioneering work by A. V. Baez (*1*), diffractive lenses (zone plates and Bragg-Fresnel structures) have been fabricated to focus both x-rays (*2*) and neutrons (*3*). The