



# UNIVERSITY OF OREGON

September 1, 1998

Prof. Stephen Leone  
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University of Colorado  
Boulder, CO 80309

Dear Steve:

The report of the Basic Energy Sciences Advisory Committee (BESAC) Panel on D.O.E. Synchrotron Radiation Sources and Science (the Birgeneau Report, dated November, 1997) placed as one of their highest priorities exploratory research on the fourth generation of light sources. More explicitly, the report recommended that another panel, comprised of potential users and builders of fourth generation light sources, be convened to advise Basic Energy Sciences on the development and application of such sources, keeping in mind the limited funding available. To this end, BESAC has now been charged by Dr. Martha Krebs to implement this recommendation of the Birgeneau report. I am delighted that you have agreed to take on the task of convening and chairing this panel.

The Birgeneau panel limited consideration of a fourth generation light source to a free electron laser (FEL) operating in the X-ray region. This definition follows from the historical development of the particle-beam technology associated with synchrotron light sources. However, we want your panel to think more broadly with respect to the definition of novel light sources to include all possible ways in which increased brightness, intensity, coherence, temporal resolution and wavelength coverage can be achieved. In particular, we would like your panel to address two primary questions:

- (1) What new science will be enabled by novel coherent light sources? Besides the obvious increases in brightness there are fundamental differences in peak intensity and coherence properties between the second and third generation synchrotron sources and the envisioned new light sources. How can the high intensities, coherence, and temporal properties of novel sources be utilized to provide new probes of matter using photons? In what fields will the new light sources have the most significant impact?
- (2) Given the present state of science and technology, what might be a reasonable research and development plan for novel coherent light sources in the next five years? How would such sources be configured (individual laboratories, modest user centers, large-scale facilities, etc.) and how might they serve the potential user community?

Your panel should be composed of scientists from diverse backgrounds, balanced among several communities but with particular emphasis on the potential user community. Included among these are experts familiar with second the potential user and third generation

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synchrotron light sources, currently operating FELs, and laboratory based laser systems. The panel should solicit input from individual principal investigators and from the management and staff of the current synchrotron light sources, FEL laboratories, and laser development centers through a focused workshop devoted to the topic of novel coherent light sources. In addition, the panel should be aware of and utilize the results of previous studies and workshops devoted to FELs and fourth-generation light sources. These include the 1994 NAS report on "Free Electron Lasers and Other Advanced Sources of Light, Scientific Research Opportunities," the 1994 "Workshop on Scientific Applications of Coherent X-Rays" (SLAC report 437), the 1996 "Workshop on Fourth Generation Light Sources" (ESRF, Grenoble, France), and the 1997 "Workshop on Scientific Opportunities for Fourth-Generation Light Sources" (APS, Argonne National Laboratory).

Both BESAC and the Birgeneau panel feel strongly that the D.O.E. synchrotron light sources have provided and will continue to provide unique capabilities for our ability to interrogate matter with photons. We look forward to your report on the direction of research and development for the next generation of light sources and on how these novel coherent sources may impact scientific research.

Sincerely,



Geraldine Richmond  
Professor of Chemistry  
Chair, Basic Energy Sciences  
Advisory Committee

cc.

Dr. Patricia Dehmer, Associate Director of Energy Research, DOE  
Dr. Martha Krebs, Director of Energy Research, DOE