The Research Laboratory of Electronics

The Research Laboratory of Electronics (RLE) is the oldest and most intellectually diverse of MIT's large interdisciplinary research laboratories. Its proud heritage dates back more than half a century, and includes achievements in fundamental and applied science and engineering that are too numerous to list here. But it is the future, not the past, that is the perpetual focus of RLE and its faculty, staff, and student researchers. The cover of this year's Progress Report provides two examples of that focus on the future.

First, it features the Laboratory's new logo, RLE at MIT, marking the start of a comprehensive modernization of RLE's outreach strategies. A fundamental component of these renewed efforts is our suite of publications. The coming year will include the reintroduction of publications that have been redesigned, as well as the inauguration of completely new publications, all focused on better communicating the current excitement of RLE research. The purpose of these new efforts is to provide a set of virtual windows through which to view the Laboratory's many and varied research programs and the premier learning environment for MIT's students that these programs help create. The role of the RLE Progress Report, in this regard, will be to review the past year's accomplishments by all of the Laboratory's investigators. One such accomplishment — experimental studies of quantum vortices in a rotating Bose-Einstein condensate, performed in the group of Professor Wolfgang Ketterle — serves as the cover graphic for this year's Progress Report, providing the second example of RLE's focus on the future.

The Bose-Einstein condensate (BEC) is a new form of matter in which all the atoms occupy a single quantum state, i.e., they all "sing in unison." Professor Ketterle shared the 2001 Nobel Prize for Physics for his BEC work, which is opening up new vistas in fundamental atomic physics and may lead to technological breakthroughs for the manipulation and control of atoms. Throughout this year's Progress Report you will find many other examples of pioneering research, spanning the full range of fields in which RLE investigators are active. To cite just one such example, I will point to the computer microvision work in the group of Professor Dennis Freeman. Professor Freeman and his students have wedded light microscopy, video imaging, and machine vision algorithms to permit quantitative micro-motion measurements to be made with unprecedented resolution and accuracy. They are using this new technology to push back the boundaries of knowledge in hearing science, through experimental studies of cochlear mechanics, and for *in situ* visualization of the internal structural motions in man-made microelectromechanical systems (MEMS). In these and many other ways, the future is happening now in RLE.

Jeffrey H. Shapiro

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