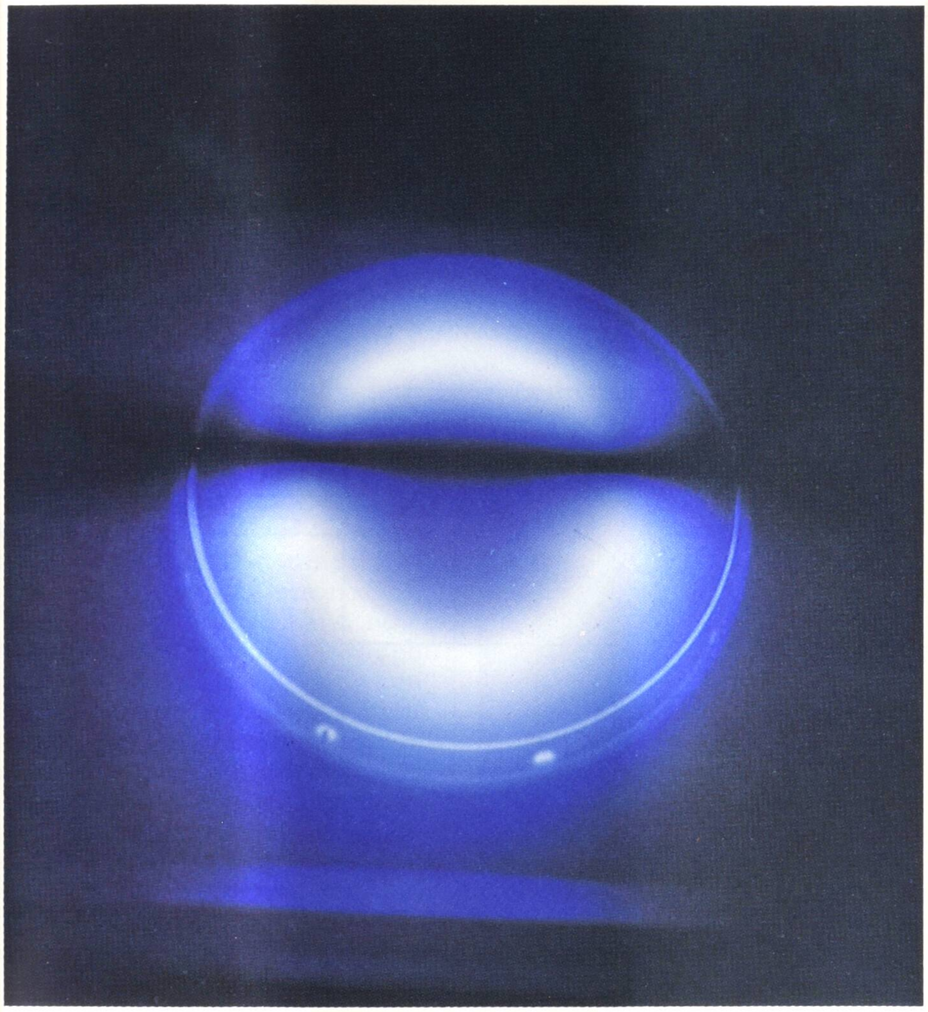
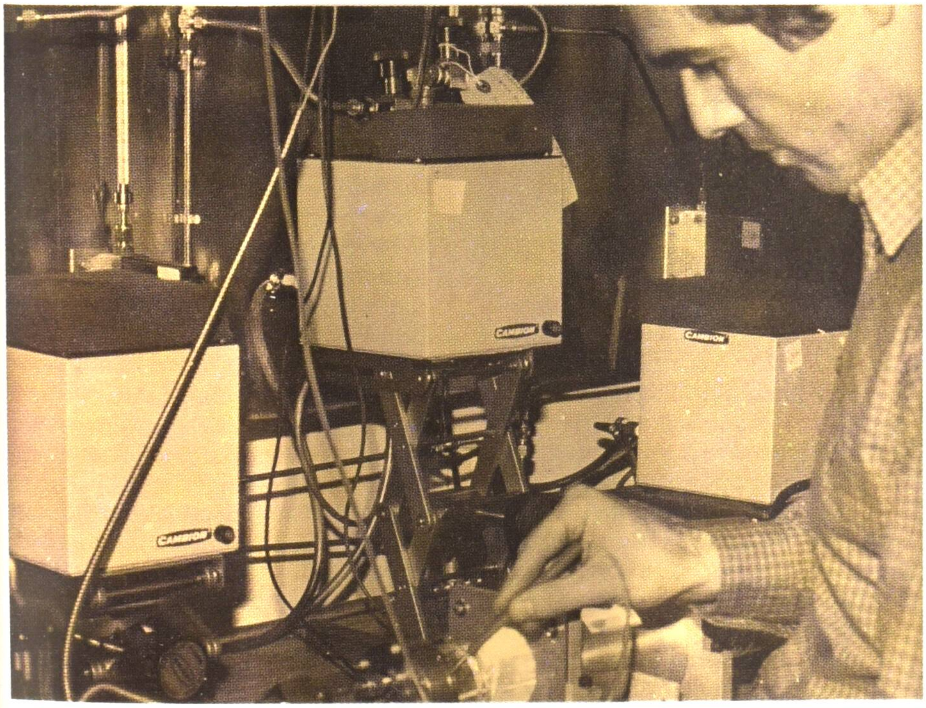


Ions glow in the circular magnetic field of a magnetron sputtering chamber used to deposit zinc oxide on a glass base.



Team member Alain Roth.

subjecting it to an electromagnetic field. The argon ions formed are forced to strike the target, and like billiard balls some of the atoms in the target fly off and diffuse through the vacuum to the substrate; there, they condense to form a film on the surface. The electrons given off during the ionization of the argon could also travel to the substrate, damaging the growing film, and to avoid this, Webb has placed a magnet behind the target; the electrons are thus swept along the magnetic field lines, away from the film.

One important existing industrial use of this magnetron sputtering technique is in the room-temperature coating of chrome films onto plastic for use as car bumpers.

Williams and Webb, however, had other concerns in mind when they examined the magnetron technique. Their interest was to make materials for devices such as solar cells. While unlikely to replace megaprojects such as nuclear reactors or the 'white coal' of James Bay, solar cells do convert sunlight directly into electrical energy, and for certain applications seem the answer to an environmentalist's prayer. The Williams-Webb-Roth group at NRC makes them by depositing metal oxide films of carefully controlled transparency, conductivity, and thickness on a base of silicon material. Their early experiments led them to a somewhat exotic material — indium-tin oxide. By continually monitoring each step in this oxide's deposition, they were able to build one of the thinnest transparent, electrically useful films of its type in existence. Films one ten-thousandth of a millimetre thick proved unique in this material, and industry responded with enquiries. But, however successful a laboratory accomplishment, indium-tin oxide thin films were not enthusiastically embraced by the solar cell industry because of the high cost.

The NRC team then turned to a more readily available material — zinc oxide — and applied the information so meticulously obtained from earlier efforts on other materials. Again, close attention to the effects wrought by small changes in the deposition process brought its reward. The zinc-oxide coating proved both highly transparent and electrically conductive, making it an