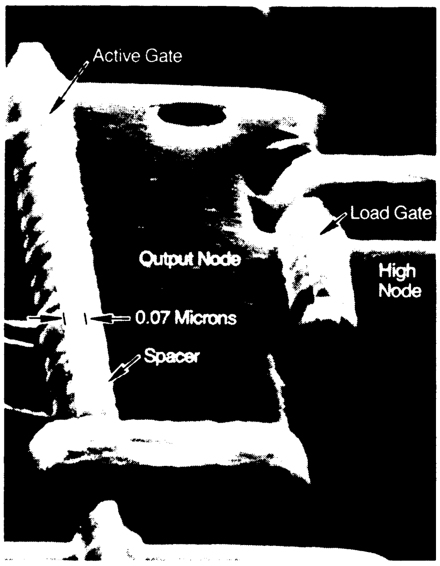

IBM

With careful engineering, including the use of electron-beam lithography for delineating device features, IBM researchers have shown that high-performance, low-temperature silicon transistors with key parts smaller than 0.1 micron can be fabricated.

George A. Sai-Halasz and his colleagues are the first to scale down — in both the lateral and vertical dimensions — all the critical features to this size and smaller.

"At these dimensions we can pack 1 million of these things on a chip with no problem at all," says Sai-Halasz. "...You could put a whole computer on not more than two or three chips."

Operating the transistors at liquid-nitrogen temperatures also enables the researchers to scale down the voltage needed to switch them on and off; this in turn reduces the power dissipated by the transistors. The low temperature also improves the performance of the devices, as measured by the transconductance, or current flow out of the device per unit change in voltage. The researchers will report in the October IEEE ELECTRON DEVICE LETTERS that the transconductance of their devices is 40 percent higher than that reported for other silicon devices operating at room temperature and is comparable to that of gallium arsenide devices (which have been pursued largely because they promised greater performance and faster speeds than their silicon counterparts).

Sai-Halasz says he's convinced that the only worthwhile semiconductor devices of small proportions will have to be cooled to low temperatures. But he doesn't view this as a technological barrier because the computer industry "is moving in that direction anyway." By the time these kinds of tiny transistors can be put in mass production, he says, "liquid nitrogen will be no problem at all." The next problem to be solved, he notes, is how to get rid of all the heat generated by extraordinarily densely packed chips.

— S. Weisburd

RNA satellites confer viral resistance

For the past decade, researchers have been aware of the existence of tiny RNA "satellites" that reside within the cells of certain crops. Little is known about these enigmatic bits of genetic material; they seem to exist in a sort of dormant state in leaf cells, incapable of replicating without the assistance of a fully formed — and often disease-causing — "helper virus." The satellites are of interest to plant pathologists because they can influence the severity of the disease caused by their respective helper viruses.

Two reports in the Aug. 27 NATURE describe advances in the use of RNA satellites as natural inhibitors of crop-damaging viruses. The research points to a promising method of genetically engineering crops to better defend themselves against disease.

Bryan D. Harrison and his colleagues at the Scottish Crop Research Institute in Dundee, Scotland, genetically transformed tobacco plants so that the plants themselves, when attacked by a virus, produce a particular RNA satellite within their cells. The plant-produced satellite takes advantage of the disease-causing cucumber mosaic virus (CMV) in order to reproduce itself, but in doing so it suppresses CMV replication.

In similar research, Wayne L. Gerlach and others at CSIRO Division of Plant Industry in Canberra, Australia, successfully inserted the gene for a tobacco-plant RNA satellite that ameliorates the symptoms of infection by tobacco ringspot virus.

"What we've shown is that this satellite production attenuates the disease, and that it also greatly decreases the replication of the virus in the genetically engineered plants. And as a result of the lower virus concentration in these plants, they are much poorer sources of virus for insects to spread to other plants," Harrison told SCIENCE NEWS.

The beauty of this method of virus control, Harrison says, is that "the satellite precursors in the plant are only activated when the virus infects, so it doesn't matter how little satellite there is at the time of infection." When challenged by a virus, satellite levels "soon build up to very high concentrations." One disadvantage, he notes, is that similar RNA satellites actually *enhance* viral infectivity. Scientists need to understand how these differ, he says, lest a minor mutation in a virus-resisting satellite leave a plant more — rather than less — vulnerable to infection.

— R. Weiss

Taking a vacuum to extraterrestrial dust

While cleaning dust out of the corners of a room may be a loathsome part of everyday existence, scientists standing on Greenland's glacial ice cap are only too glad to do a little vacuuming. From the bottom of shallow lakes that form on the ice, they are collecting black dust that is helping to answer some cosmic questions, including how the early solar system developed.

Several years ago, researchers discovered that this black dust actually contains micrometeorites measuring about one-tenth of a millimeter across. In fact, the annual thawing cycle on the ice cap concentrates the extraterrestrial grains at the lake bottoms, making these the richest known deposits of micrometeorites on the earth's surface (SN: 8/30/86, p.133).

This year, Michel Maurette of the University of Paris and his colleagues finished a thorough analysis of the sizes and compositions of the micrometeorites — an analysis that is yielding unexpected results. "In addition to families of grains never reported before," write the researchers in the Aug. 20 NATURE, "we have found a suprisingly high abundance of unmelted chondritic fragments."

While chondritic fragments are the most abundant type of micrometeorite, scientists previously had thought that unmelted grains were extremely rare. However, the researchers found that about one-fourth of the total micrometeorites were unmelted and many were relatively large. They propose that a "very effective cooling mechanism" protected the grains from a fiery demise as they soared through earth's atmosphere.

Moreover, when Maurette's group compared the micrometeorites taken from Greenland with those collected from outside the earth's atmosphere by satellite, they found that each sample had a similar distribution of sizes. Such a correlation suggests that the grains found on earth come from a population of micrometeorites that inhabits the inner solar system.

Many believe that these micrometeorites come from comets, the so-called dirty snowballs that vaporize as they orbit the sun. Since comets are thought to have developed before the sun and planets, scientists study micrometeorite composition as a representative of the primordial matter that eventually coalesced into the solar system, says Ian Mackinnon, a cosmochemist at the University of New Mexico in Albuquerque. With Greenland yielding much larger grains than other sources — such as the deep sea — scientists will now be able to perform a wider range of physical and chemical tests on this cosmic dust.

— R. Monastersky