

## **A New Frontier of Computing**

We all recognize the feeling of panic when your computer crashes and you realize you forgot to save your progress for the past couple of hours. In this scenario you wait for the computer to boot again and assess what you have lost. Imagine instead the computer booting instantly and you find yourself exactly where you left off. With an emerging technology in computer design this could become the new reality.

The basic idea behind the fundamental building block of your electronic devices, known as the transistor, has since its invention in the 1960s been largely unchanged. The design which proved most successful is known as the Metal-Oxide-Semiconductor Field Effect Transistor (MOSFET) and is by far the most common design even to this day due to its cheap manufacturing process and its ability to be scaled down to ever smaller devices. However, in the last decade one has started to reach the limits of the MOSFET design, primarily due to limited scalability, and alternative designs are actively being explored.

A promising design is the Ferroelectric Tunnel Junction (FTJ) which utilizes the small dimensions of the transistor to its advantage where electrons tunnel through a thin barrier. This barrier is then manipulated to either allow electrons through or not, resulting in the characteristic transistor functionality. In addition to being intrinsically small, the ferroelectric barrier allows the transistor to be toggleable where the state of the transistor is maintained even though power is lost. This ability means that electronic devices utilizing this design does not have to be booted up, as all transistors are already set to the desired state. Additionally, as power is only consumed as transistors are being toggled between states, these devices could reduce power consumption lengthening the battery life across all devices.

However, for this to become the new reality of computers, the FTJ design must be improved further to prove as an effective alternative to the MOSFET design. One limiting factor is believed to be the interfaces of the ferroelectric barrier layer. Utilizing a new technique known as Flash-Lamp Annealing (FLA) the processing of the ferroelectric barrier layer can be made up to 10 000 times faster which could significantly improve the interfaces. This as the material can set much faster resulting in better defined interfaces. If successful, this could be a crucial step for this new transistor design to become a viable alternative to MOSFETs and bring in a new frontier of computing.