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## Development of High-Electron-Mobility Transistors (HEMT)

In the latter half of the 1970s, aiming at the high performance of electron computers, there was active research into the improvement of high-speed signal processing equipment or communication equipment for microfabrication technology for Si devices. On the other hand, research and development into Josephson devices which make use of superconductivity and are expected to have high-speed motion to exceed the limited performance of Si devices and compound semiconductors, faster than Si in terms of electron mobility, and, above all, GaAs. In 1979, when competition on development was strong, ultrafast devices arrived, taking the high electron mobility of metal-oxide semiconductor GaAs to the utmost limit. This was the high-electron-mobility transistor (HEMT) invented by T. Mimura, S. Hiyamizu, et al. Beginning with this invention was the finding of a phenomenon where a 2D electron layer was generated and accumulated on the heterojunction crystal face composed of GaAs and AIGsAs, i.e., different materials.
In 1985, HEMT was put into production by Fujitsu Limited as the least noisy microwave semiconductor device in the world and was adopted by the Nobeyama observatory for a radio telescope. In addition, because of its low noise, the downsizing of satellite-television antenna became possible. From 1987, HEMT was mounted on satellite receivers around the world.
HEMT: High Electron Mobility Transistor

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## Pioneering Study on Quantum-effect Devices

As the executable size of crystals composing of semiconductor devices reaches the quantum-mechanical wavelength (about 100A) of an electron, the electron actualizes the wave character rather than the character of the particles, and thus there are various phenomena not seen in conventional semiconductors. The appearance of such quantum effects necessitated the reconstruction of conventional device designs and methods of analysis based on kinematic wave theory, and at the same time it brought about the possibility of realizing previously impossible high performance devices.
H. Sakaki, Y. Arakawa, et al., focused on the importance of this quantum effect. They carried out a series of studies to figure out electron wave behaviors in micro device structure as well as to create new device structures and physical conceptions effective for realizing desired functions, and thus played a pioneering role in the development of a new field of study, quantum wave electronics.