



# Gwangju Institute of Science and Technology

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## Professor Byoung Seung Ham proposes a new method for absolutely secure wireless communication that self-corrects signal distortion

- GIST (Gwangju Institute of Science and Technology, President Kiseon Kim) School of Electrical Engineering and Computer Science Professor Byoung Seung Ham (Center for Photon Information Processing) proposed a new absolutely secure wireless communication protocol that self-corrects signal distortion caused by air, wind, fog, clouds, rain, etc. in LiDAR\*, which is a key element of next-generation wireless communication or autonomous vehicles.

\* LiDAR: A device that recognizes the surrounding environment in 3D and helps autonomous vehicles drive safely by continuously emitting millions of laser beams per second and calculates the distance by measuring the time it returns to the sensor. LiDAR recognizes and tracks obstacles, people, cars, etc. while driving, and it can recognize road lane boundaries and traffic lights ahead with high accuracy.

- Professor Byoung Seung Ham not only corrected the signal distortion, which is the limit of lidar, but also identified and demonstrated the principle of wireless classical cryptographic communication, a next-generation source technology that satisfies speed and security at the same time and is one of the four elements of future autonomous vehicle technology.



- The proposed technology in this research is compatible with current commercial systems, and it is expected to be highly related to new wireless security communication technologies that solve unconditional security with intense light sources, i.e., lasers, not single photons, and implements the nonlinear phase pair principle as a double Mach–Zehnder interferometer.
- For existing quantum cryptographic communication, the absolute security principle is based on the principle of non-replicability of quantized signals, but in this research, absolute security was implemented not by quantization of signals but by quantization of channels (quantum superposition), and the key distribution process is the same as the optical memory principle. The encryption key generation/exchange speed is similar to the wireless communication data transmission speed.
- Most importantly, the absolutely secure wireless communication technology proposed in this research is compatible with existing wireless communication devices, and it has the advantage of self-correcting signal distortion caused by the radio wave medium like phase conjugation. Therefore, it can be applied directly to the LiDAR, which is essential for autonomous driving, without the help of software, camera sensors, or radar, and, furthermore, wireless quantum communication can be applied to Quantum LiDAR, which is a future technology.
- Professor Byoung Seung Ham said, "This research has produced the world's first wireless classical encryption key distribution technology that guarantees absolute security and corrects signal (image) distortion by itself, which is impossible with any conventional method. In the future, this absolutely secure wireless communication technology will be applied to defense networks, administrative networks, financial networks, as well as medical data transmission for telemedicine, education networks for remote lectures, and future self-driving cars."
- The research results were published online on January 21, 2021 in *Scientific Reports*, a sister magazine of Nature, a sister journal of Nature.

