Towards hybrid quantum systems

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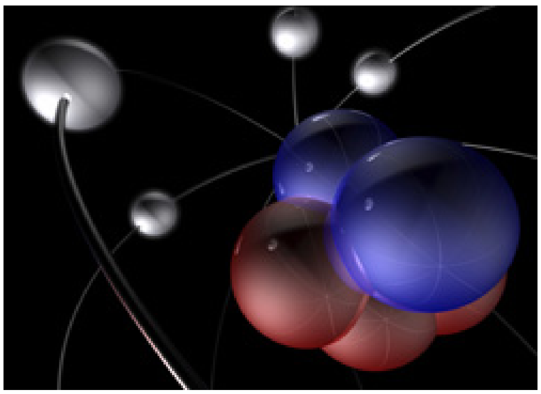

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EU-funded scientists made advances in the development of a hybrid quantum system (HQS) by combining different quantum technologies.

Quantum physics have a tremendous potential to be used in many methods and technologies. However, for quantum physics to emerge from fundamental research, the different systems need to be linked to each other while preserving the quantum nature. Currently, such a technological basis is lacking.

To address this issue, the 'Hybrid quantum systems - integrating atomic/molecular and solid state quantum systems' (HQS) project combined ultracold atoms with superconducting devices. Scientists considered that an ensemble of ultracold atoms could be coupled to a superconducting transmission line resonator and that the coupling strength could be enhanced by optically excited Rydberg states.

At the experimental level, a dilution refrigerator system was used to measure superconducting resonators which showed quality factors up to a million. In addition, the effect of light impinging on the resonator was tested and provided significant information for systems requiring light pulses.

Regarding the cryogenic atom chip development, scientists demonstrated strong coupling even at finite temperatures using a 4K resonator. An alternative HQS was developed by coupling a diamond to a superconducting resonator. It was shown that an ensemble of nitrogen-vacancy spins could strongly couple to the superconducting resonator.

The HQS project provided a platform for integrating quantum systems. The developed technology is expected to have a wide variety of applications and bring quantum physics closer to the real world.

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