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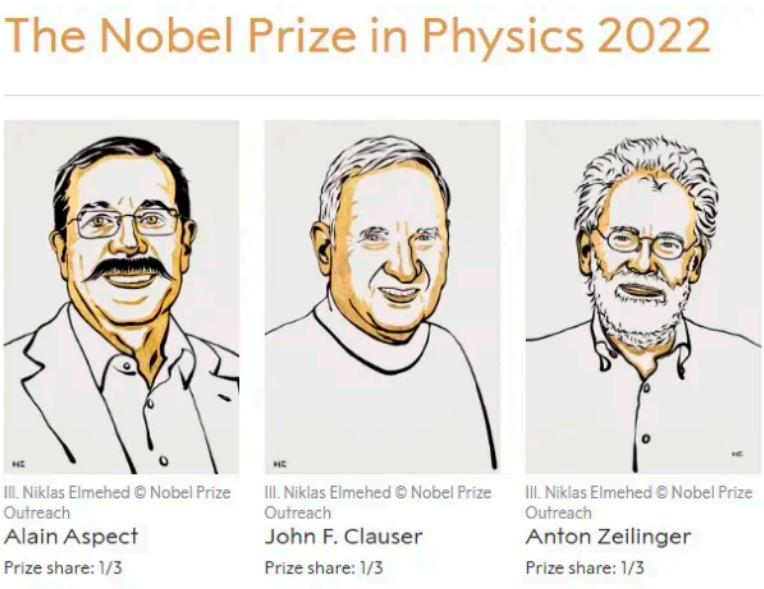
SELECTED NEWS

The Nobel Prize in Physics 2022

Entangled states – from theory to technology



Alain Aspect, John Clauser and Anton Zeilinger have each conducted groundbreaking experiments using entangled quantum states, where two particles behave like a single unit even when they are separated. Their results have cleared the way for new technology based upon quantum information.

John Clauser developed John Bell's ideas, leading to a practical experiment. When he took the measurements, they supported quantum mechanics by clearly violating a Bell inequality. This means that quantum mechanics cannot be replaced by a theory that uses hidden variables.

Some loopholes remained after John Clauser's experiment. **Alain Aspect** developed the setup, using it in a way that closed an important loophole. He was able to switch the measurement settings after an entangled pair had left its source, so the setting that existed when they were emitted could not affect the result.

Using refined tools and long series of experiments, **Anton Zeilinger** started to use entangled quantum states. Among other things, his research group has demonstrated a phenomenon called quantum teleportation, which makes it possible to move a quantum state from one particle to one at a distance.

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Building the future of quantum error correction

Last week's IEEE Quantum Week conference put the spotlight on the latest research in error correction — and a glimpse of what quantum computing's future may look like.
Researchers in the field have made significant progress in quantum error correction over the last few years, but there's still much left to accomplish to achieve this goal. Today, we're working with the broader quantum community to thoughtfully bring about practical quantum computing as soon as possible. As part of our development roadmap, we see the development in this field as a continuous path forward, where we work to create value from today's noisy quantum hardware using error mitigation techniques, while IBM scientists and the broader research community develop scalable Quantum Error Correction (QEC) technologies.

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No. 1, Sec.4 Roosevelt Rd., Da'an Dist. Taipei City 106319, Taiwan

ntuq2018@gmail.com :+886 2-33669928 http://quantum.ntu.edu.tw/