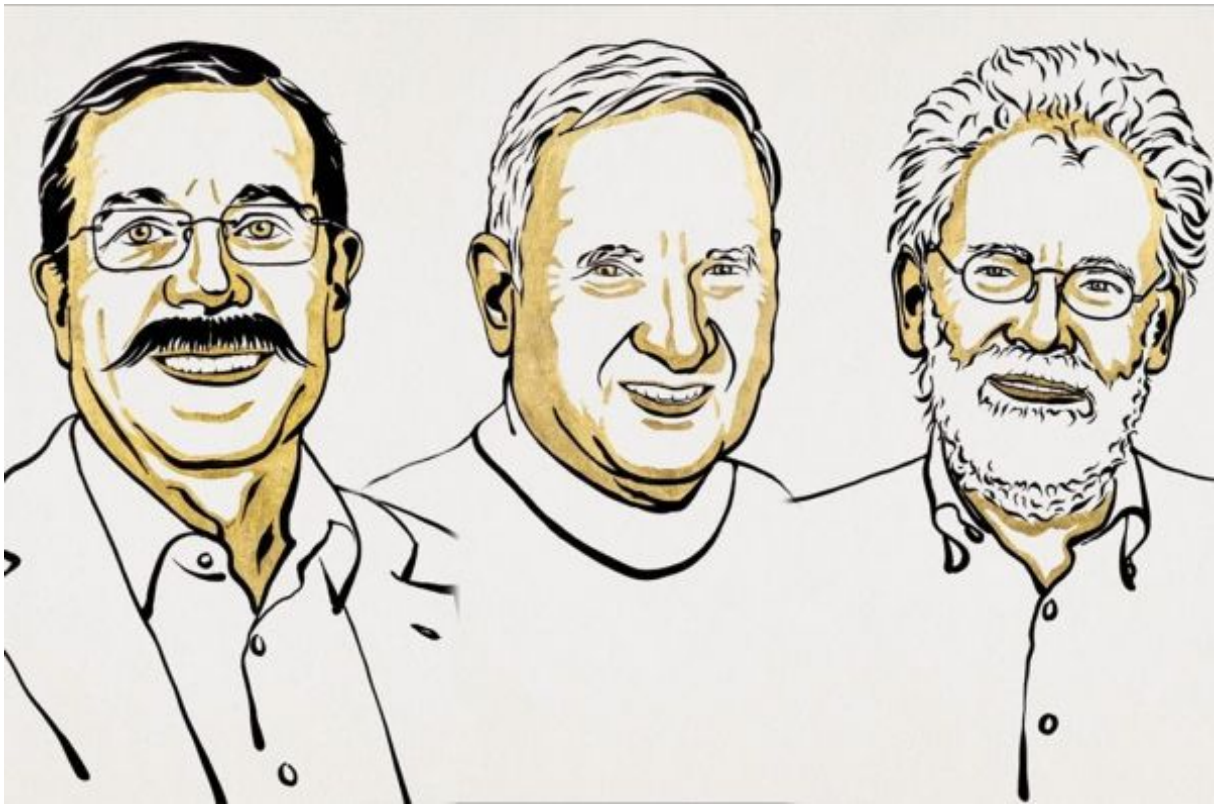

2022 Nobel Prize in Physics

Alain Aspect, John Clauser and Anton Zeilinger receive Nobel i¿½for experiments with entangled photons, establishing t e violation of Bell inequalities and pioneering quantum informati n sciencei¿½

October 04, 2022

The 2022 **Nobel Prize in Physics** has been announced by the Royal Swedish Academy of Sciences, giving this prestigious award to three fathers of Quantum Physics, **Alain Aspect**, **John F. Clauser**, and **Anton Zeilinger** for "experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science".
ICFOnians full heartedly congratulate these friends and colleagues who have made landmark contributions to the field of quantum physics for which they are justly being recognized with this award. The major and unique contributions to the field these renowned scientists have made have helped usher the world into the Second Quantum Revolution, and are facilitating a tremendous scientific and technological transformation that will shape the future.
During the Nobel in Physics announcement, Anders Irback, Chair of the Nobel Committee for Physics highlighted this contribution, commenting i¿½It has become increasingly clear that a

new kind of quantum technology is emergingi¿½.

The three laureates have been awarded for the following contributions to the fie

John Clauser has been recognized for his contribution to John Bell's ideas, leading to practical experiment. His experiments proved the validity of quantum mechanics by clearl violating a Bell inequality and thus showing that quantum mechanics cannot be replaced b any theory that uses hidden variables

Clauser's experiment left some experimental loopholes open**Alain Aspect** closed a important loophole by designing an experimental setup in which he was able to switch th measurement settings after an entangled pair had left its source, making it impossible for th setting that existed when they were emitted to affect the result

Anton Zeilinger aimed at controlling entangled quantum states through a long series o experiments. His research group was able to demonstrate quantum teleportation, whic means being able to replicate a quantum state from one particle to one at a distance Zeilinger's experience in the fields has positioned him as one of the precursors and drivers o the European Quantum Flagship initiative, that aims to overcome current limitations in th field and drive innovations that will bring breakthroughs in the development of quantu technology applications

Several ICFO researchers, including**Morgan W. Mitchell**, **Valerio Pruneri**, **Soren Wengerowsky**, ICFO Alumni **Carlos Abellan** (CEO and co-founder of Quside), **Waldimar Amaya** (COO and also co-founder of Quside)**, Timothy H. Taminiau, Fabien Steinlechner, Daniel Cavalcanti,** and **Stefano Pironio**, contributed to several different studies, include Zeilinger's loophole-free Bell test experiments in 2015. These studies have been included in the reference section of the Nobel press release, giving the scientific background information on this prize. ?

A longer list of ICFOnians, in particular**Antonio Acin**, **Maciej Lewenstein**, and **Juan P. Torres** have had the honor of engaging with the laureates on a range of topics through the years, further emphasizing the tremendous scope of their influence. ICREA Prof at ICFO Dr Maciej Lewenstein who has ongoing collaborations with Aspect comments, i¿½In addition to fundamental studies of nonlocality, Alain Aspect made seminal contributions to the physics of Bose-Einstein condensation and ultracold gases, condensation of metastable Helium, Anderson localization in ultracold atomic gases among many other areas. His enormous contribution across AMO physics cannot be overstated.i¿

? ICREA Prof at ICFO Dr Morgan W. Mitchell sums up his sentiments on hearing the news of th s year's award as follows: i¿½was born in the Cold War, when physics was very useful, but thinking hard about what physics meant was considered a waste of time. David Mermin, one of the wittiest physicists of the era, called this the i¿½Shut up and calculate!i¿½ era. To ay's Nobel Prize winners are physicists who refused to stop thinking about the question i? ½what does all this mean?i¿½, and found ways to do experiments at the border between ph sics and philosophy. They also refused to i¿½shut up.i¿½ In fact, they wrote so eloque

tly that the physics world eventually (after about 50 years) came to realize that i¿½w at does it all meani¿½ can be one of the most practical questions out there. All our e forts in quantum technologies are indebted to these pioneers

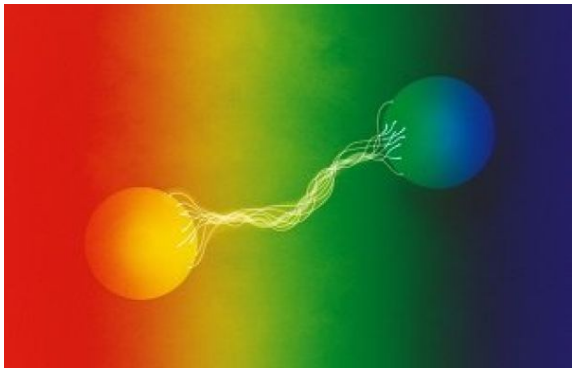

Illustration Entanglement |Johan Jarnestad / The Royal Swedish Academy of Sciences