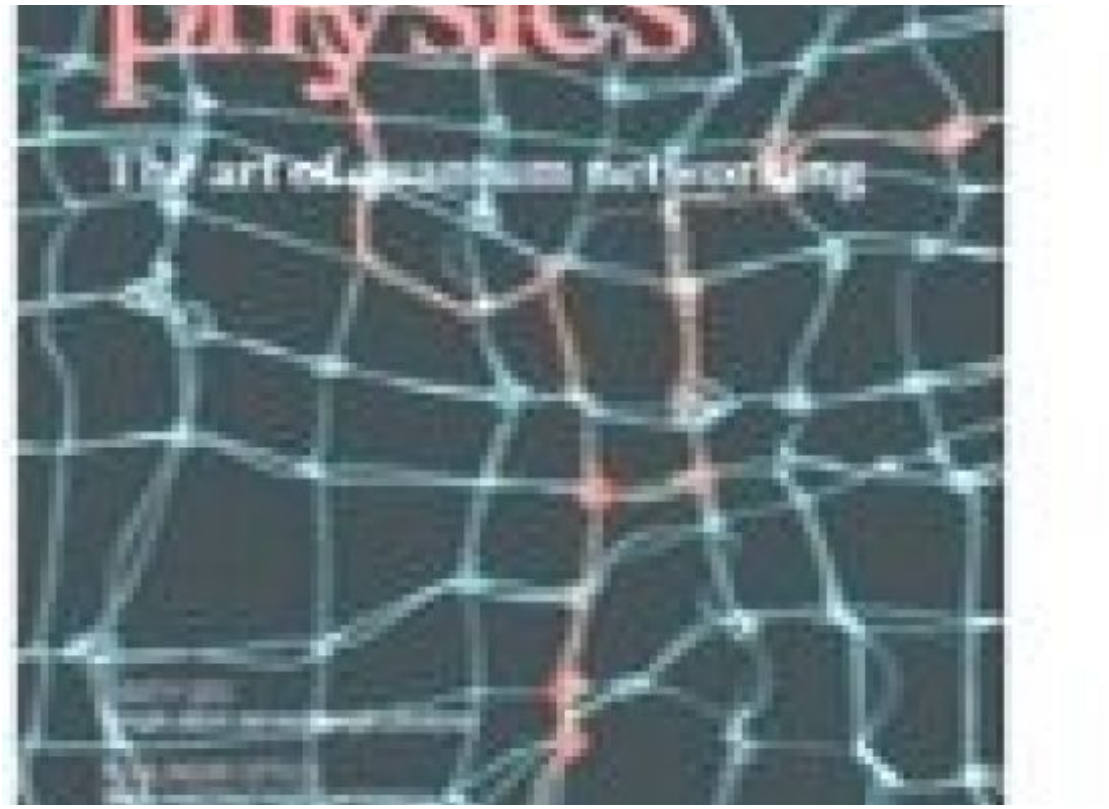

ICFO research in Nature Physics's front page

New astonishing properties of quantum networks discovered by Profs. Acin, Cirac and Lewenstein

April 02, 2007

Future internet and communication networks will use the laws of micro-world, i.e. quantum mechanics. In such quantum networks it will be of primary importance to establish quantum entanglement, i.e. genuine quantum correlations over large distances. Such correlations cannot be created by classical communications and have truly quantum origin. That is why they allow that to perform fascinating quantum tasks: to realize quantum teleportation, to establish secure confident communication, or to realize quantum computation. In order to establish entanglement, distant nodes of the network should share pairs of correlated particles (photons, atoms, etc.). Unfortunately, establishing of perfect correlations even over short distances is a formidable task: Only imperfect ones can be realized in experiments.

Prof Antonio Acin and Maciej Lewenstein, together with Prof Ignacio Cirac, Max-Planck Institute for Quantum Optics and Distinguished Invited Professor at ICFO, show in a recent paper published in Nature Physics that nevertheless establishing perfect correlations over large distances from imperfect ones is possible.

The paper shows that although it is impossible in networks that consist of linear series of nodes, it is possible in multiconnected networks, similar to those used nowadays for internet or telecommunications. This remarkable possibility occurs due to what the authors call "quantum entanglement percolation".

Two national newspapers, La Vanguardia, and El Pais, have recently highlighted this research.