



SCIENTIFIC REPORT (PART 1)			
	EUROPEAN COMMISSION RESEARCH DG		HIGH-LEVEL SCIENTIFIC CONFERENCES SCIENTIFIC REPORT
	HUMAN POTENTIAL PROGRAMME		
Contract No	HPCFCT –2000-00280	Proposal Short Title	QUICK
Event No <sup>1</sup>	1	Event Short Title	QUICK
Event Start Date	06/04/2001	Event Duration	5 days
Event Location	Cargese, Corsica	Country Code <sup>2</sup>	Fr

Information on Participants (Regardless of Funding Source)		
Total number of young researchers <sup>4</sup> ,	who are nationals of, and active inside, a Member or an Associated State <sup>5</sup>	42
	who are nationals of, but active outside, a Member or an Associated State <sup>5</sup>	3
Total number of researchers of any age <sup>3</sup> who are nationals of,	and active inside, a Member or an Associated State <sup>5</sup>	80
	and active outside, a Member or an Associated State <sup>5</sup>	3
	the New Independent States (N.I.S.) <sup>8</sup>	5
	the USA	8
	Japan	1

Presentation & Publication <sup>6</sup>			
Total number of keynote presentations/lectures <sup>7</sup>			38
Total number of oral contributions	41	Number of oral contributions from young researchers <sup>4</sup>	5
Total number of posters	36	Number of posters from young researchers <sup>4</sup>	36
Total number of contributions published in refereed scientific journals			10
Total number of contributions published in any other publication			~10

Project's Homepage & Other Links		
Indicate any relevant web addresses where additional information can be found on this project	Homepage:	<a href="http://www.ele.kth.se/QEO/QUICK">http://www.ele.kth.se/QEO/QUICK</a>
	Other Links:	

- 1) Enter the event number for an Event Report and F for a Final Report.
- 2) Enter official Commission Country Code (see Annex IV).
- 3) Enter totals including Young Researchers.
- 4) Young Researchers are researchers up to an age limit of 35 years at the time of the event. Allowance is made for compulsory military or civil service and childcare (maximum 2 years per child for the actual time spent off work).
- 5) On 01 July 2001, Member States are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, United Kingdom, and Associated States are: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia, Iceland, Liechtenstein, Norway, Israel. For up-to-date information look at <http://www.cordis.lu/fp5/src/3rdcountries.htm>.
- 6) If not applicable to the event, enter N/A.
- 7) Invited keynote speakers or lecturers must be internationally recognised experts in the topic concerned. They must have an active role in the event.
- 8) For further details look at <http://www.cordis.lu/fp5/src/3rdcountries.htm>.

SCIENTIFIC REPORT (PART 2)			
	EUROPEAN COMMISSION RESEARCH DG	HIGH-LEVEL SCIENTIFIC CONFERENCES SCIENTIFIC REPORT	
	HUMAN POTENTIAL PROGRAMME		
Contract No	HPCFCT –2000-0280	Event No <sup>1</sup>	

### Summary (maximum 2 pages)

**Scientific Highlights:**

A primary aim of the conference was to review the technologies being developed for secure key exchange using the technique of Quantum Cryptography. In this vein it featured updates on the progress of free space key exchange using quantum cryptography to 2km and beyond (Rarity, Hughes) and a thorough review of the possibility of extending free space quantum cryptography to satellites (Gilbert). Miniature technologies for fibre and free-space systems were reviewed by Kurtseifer while the extension of fibre based links to 80km was highlighted by Buller. Several novel schemes for quantum cryptography were described including side-band modulation (Goodgebuier), three party protocols (Imoto, Karlsson) and entangled state schemes (Zbinden). Practical security issues were well reviewed by Lutkenhaus.

A second aim was to review emerging technologies to be used in the next generation of quantum communication schemes. These include single photon sources (Gerard, Zwiller, Pelton, Gayral) and the emerging field of continuous variable quantum communications (Leuchs, Giacobino). The US programme to develop a ‘quantum internet’ was described by Shapiro.

A final aim was to discuss the new Physics that may lead on to future quantum communications. In this vein we were able to hear the first reports of four photon interference from various groups: in stimulated downconversion (Bouwmeester) and in four photon GHZ states (Jennewein, Kurtseifer). Studies of single photon level non-linearities were reviewed in keynote talks from Brune and Rempe. The trapping of single atoms at the focal point of a high numerical aperture beam was introduced by Grangier.

**Training:**

The conference brought together experts and students of the field of quantum communications in a convivial location. Long breaks afforded plenty of discussion time and poster sessions were lively events where the younger attendees were able to present the truly new work to the established community. The conference provided the ideal opportunity for a young researcher to become immediately fully immersed in the forefront of the field.


The conference also acted as an international job shop. Various students wishing to find future positions were able to make their first visual contact with potential PhD and Postdoc supervisors. Almost all of the junior reseachers will be moving to the next stage of their career within a maximum three year timespan. I estimate that at least 10 students benefited directly from this aspect of the conference.

**European Added Value (incl. Networking):**

The EP28139 EQCSPOT, and programmes of the FET Quantum information processing and communication cluster: QUCOMM, S4P, EQUIS, QUICOV all held project meetings at this conference. This conference covered the full range of quantum communication projects funded under the IST programme and allowed cross-fertilisation between projects A key benefit was the full mixing of the PhD and postdoc level staff. This is indispensable as the know-how exchanged in this informal way saves a lot of time and consequently EU monies.

**Additional Information:**

1) Enter the event number for an Event Report and F for a Final Report.

SCIENTIFIC REPORT (PART 3)			
	EUROPEAN COMMISSION RESEARCH DG	HIGH-LEVEL SCIENTIFIC CONFERENCES SCIENTIFIC REPORT	
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Contract No	HPCFCT –2000-0280	Event No <sup>1</sup>	

**Public Outreach<sup>2</sup> (maximum 1 page)**

QUICK: Quantum interference and cryptographic keys: novel physics and advancing technologies.

This conference brought together the experts and the students of this emerging field in the convivial location of the Cargese Institute (Institut d’Etudes Scientifique de Cargese, Corsica).

The key to this field is two-fold:

- 1) We can show that single particles of light, photons, still have wavelike properties and show interference effects (**wave-particle duality**)
- 2) We use these photons and their wavelike properties to carry bits of information (**quantum communications**) and to perform simple logic (**quantum logic**).

The simplest and most practical use of this is a secure communication scheme for sharing cryptographic keys known as **Quantum Cryptography**. The security of this scheme is in fact guaranteed by Heisenberg’s Uncertainty principle, which roughly states you cannot know everything about a quantum object. We encode the data in a way that anyone listening-in would have to measure everything about each photon and as a result the photons are disturbed in a measurable way. By monitoring the received data for disturbance the presence of eavesdroppers can be detected. This conference acted as a showcase and discussion forum for the various groups and their latest quantum cryptography experiments. The technologies required to build quantum cryptography systems were discussed in detail. Future extensions of the general field of quantum communications were discussed along with the new physics of multi-photon interference, and quantum logic. Far sighted applications of the new physics for instance for a **quantum internet** were hotly discussed. The general opinion is that such widespread application is still a long way off.

1) Enter the event number for an Event Report and F for a Final Report.  
 2) Please provide in this section a **summary** of the content of the event for the **general public**