***Associateship Scheme***

*(5/4/2012****)***

**VISITING ASSOCIATE REPORT - FORM B**

**Please complete this form carefully at the end of your visit and return it to the Associateship Office.**

**This information is vital for the continuation of the Scheme.**

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**Full name & address of permanent Institution : Tel. No.:**00 212 5 28 22 09 57.

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**Full name & address of present Institution**

**(if different from permanent):**

**Tel. No.:**

**Address: Telefax**

**City:**

**Electronic mail address:**

**Country: Zip code:**

**Temporary address valid until:**

**Date of Arrival at ICTP:** 19/7/2014 **Date of Departure from ICTP:** 20/9/2014

**Period/s spent outside ICTP in connection with present Associateship visit:**

**Institute/Town/Country:**

**Reason for visit:**

**Field of Research:**

**Kindly specify below (using a maximum of 150 characters) your current main resesarch topics:**

In multi-qubit systems, quantum correlations constitute a valuable resource for many quantum protocols (quantum communications, quantum computing). Henceforth, the quantification, characterization and classification of the various correlations in multipartite systems is of paramount importance in the context of quantum information science. Different measures and various approaches were proposed in the literature. They can be classified in two main categories: entropic and geometric measures. In the other hand, the understanding of decoherence effects is essential for dynamical evolution of the correlations contained in a quantum system when interacting with its environment. This can provides us with the adequate strategies to prevent against the quantum correlations lost. Another interesting aspect concerns the information encoded in coherent states. In this encoding scheme, the information is encoded in continuous variables instead of the discrete qubits. The multipartite quantum correlations in such quantum systems constitute another main topic of my current research activity.

**Give a brief description of the research work carried out during your visit.**

In analyzing the quantification of quantum correlations in multi-qubit systems, we devlopped a recursive approach for determining the Hilbert-Schmidt measure of pairwise quantum discord in a balanced superposition of symmetric n-qubit states (multiqubit Shrodinger cat states). This recursive method in deriving pairwise geometric measures of discord is based on recursive relations between the Fano-Bloch correlation matrices. We especially developed a general algorithm to determine the explicit expressions of quantum-classical states exhibiting zero discord. A paper summarizing this work is submitted to journal of mathematical physics.

In the other, since the coherent states of the quantized electromagnetic radiation are useful in encoding quantum information, we investigated the influence of photon excitations on quantum correlations in tripartite Glauber coherent states of Greenberger-Horne-Zeilinger type. We quantified the pairwise correlations by means of the entropy-based quantum discord. We analyzed the monogamy property of quantum discord in this class of tripartite states in terms of the strength of Glauber coherent states and the photon excitation order. The results are submitted to “Quantum Information Processing” for publication.

In collaboration with Chung (Gyeongsang National University, Jinju 660-701, Korea), we investigated the algebraic structure and representations of a class of polynomial u(2) algebra. This algebra covers many variants of the usual u(2) algebra and Weyl-Heisenberg algebra. It is also related to dynamical symmetries of different exactly solvable models like for instance the Higgs oscillator. The analytical representations of this class of generalized algebras are also constructed via the coherent states formalism. A paper resuming these results is submitted to Modern Physics Letters A.

**Give details of lectures and seminars given at ICTP and/or elsewhere during your visit.**

**List scientific activities attended at ICTP and/or elsewhere during your visit and the benefits obtained from such activities.**

During my visit, I have attended to the following activities:

1. School on Non-linear Dynamics, Dynamical Transitions and Instabilities in Classical and Quantum Systems (14 July - 1 August)

2. Summer School on Cosmology (4 August - 15 August)

3. Conference on Field Theory Methods in Low-Dimensional Strongly Correlated Quantum Systems (25 August - 29 August)

**List titles of papers/preprints published or submitted for publication during your visit.**

1. A recursive approach for geometric quantifiers of pairwise quantum discord in multiqubit Shrodinger cat states

(submitted to Journal of Mathematical Physics)

2. Monogamy property of quantum discord in photon added Glauber coherent states of GHZ-type

(submitted to Quantum information processing)

3. A polynomial class of u(2) algebras

(submitted to Modern Physics Letters A)

**Give details of scientific collaborations/contacts made during your visit.**

I started a collaboration with F. Fanchini (Simons associate from Brazil) concerning the relation between

The entanglement of formation and quantum discord in multi-qubit states.

I also discussed with many scientists, visiting ICTP or/and attending some activities, the main of their research topics especially

with scientists working on questions related to quantum information.

**Which research facilities at ICTP have you found most useful to your work?**

Online access to journals.

Computing facilities.

The permanent help of the ICTP staff (scientists as well as others)..

**To what extent have you accomplished the scientific programme you planned for during your visit?**

During two months visit, I realized almost 80% of my previously planned program.

**Comment on the relevance and impact of your scientific activity at the ICTP to your scientific work in your country.**

My regular visits to AS-ICTP are of great importance for my research activities and have also an important impact on my career.

In the other hand, visiting ICTP allows me to attend to high quality conferences, seminars organized by ICTP.

**VERY IMPORTANT:**

This is my second visit as associate member. I visited several times the centre before. Thanks to the different schemes support (federation, visiting program …), I benefited from the ICTP facilities and this helped me in many respects.

**- NUMBER OF REFEREED INTERNATIONAL JOURNALS/PROCEEDINGS AT START OF ICTP visits 10**

**- NUMBER OF REFEREED INTERNATIONAL JOURNALS/PROCEEDINGS PRODUCED SINCE THEN 75**

**TOTAL NUMBER TODATE 85**

**Please suggest ways in which the ICTP could be of greater assistance to your future research work.**

**Other comments and suggestions.**

I would like to thank all the AS-ICTP members and especially the associate office.

***Signature: Date: 16/09/2014***