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**Scientific Report:
Superconducting transport through a spin-correlated quantum dot**

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The purpose of my visit of the University Aix Marseille together with Prof. Dr. R. Egger was aimed to strengthen our collaboration with the group of Prof. Dr. Thierry Martin with an opportunity to carry out a new project. During the visit, we started working on the research project devoted to the study of spin-orbit coupling on the Josephson current through a nanoscale multilevel quantum dot. Recently, this problem became a subject of serious investigations by both theoreticians and experimentalists.

The effect of Rashba spin-orbit interaction on Josephson transport is a subtle one which involves spin-rotation $SU(2)$ symmetry breaking by the spin-orbit coupling and time-reversal symmetry breaking by the phase difference between two superconducting electrodes. As a result of the breakdown of the two symmetries, the Andreev doublets are split, which might lead to qualitatively new effects in a weak superconductivity, in particular, to an anomalous supercurrent-phase relation. By using both the Hamiltonian and the scattering matrix approaches, we investigated quantitatively the role of Andreev level splitting on the Josephson current and analysed the conditions for occurrence of striking effects of Rashba spin-orbit coupling. As the main result, we have found that the interplay of spin-orbit interaction, Zeeman splitting and junction asymmetry may lead to the appearance of anomalous supercurrent even in the absence of any phase difference across the junction.

When completed, our results are planned to be submitted for publication in the Physical Review journal.