***You should outline your motivation for the choice of your research field (what have you done so far):***

Since the assumption based on theory is that quantum computer can outperform the classical one by many orders of magnitude for the specific classes of algorithms, I am very happy to be a part of the research community, trying to develop the basic unit and coupling mechanisms for the basic unit of such a computer, called qubit.

Coherence vs manipulation time ratio is the main qubit parameter that needs to be boosted. There are several different approaches to a qubit realization. Approach in our group is based on hole spin in semiconductor material called silicon germanium. Because of low hyperfine field and high spin-orbit coupling for heavy holes in germanium, coherence vs manipulation time ratio should be high, according to the theoretical proposals.

Another big barrier for realizing quantum computer is scalability – qubit number need to be scaled up to the array of a large number of qubits for performing a quantum algorithms. Nanofabrication compatibility of a silicon germanium with the CMOS industry helps to lift this barrier. Using already predefined gates for sensing a state of a qubit lifts the other barrier towards scalability solving the state readout in non-invasive way which is not the case for the conventional charge sensor readout technique. *(Put here double dot qubit in our group)*

Previously listed advantages of the spin qubit realization approach used in my scientific group makes me motivated to pursue the goal to prove this theoretical predictions also experimentally.

***Why you have chosen IST as your host:***

I am happy to be a part of the IST because it is very international institution with very high and ambitious goals. Senior scientists here are very good which help me in development of the scientific skills and knowledge by learning from them. It is also very well equipped which gives mine, as well as the other scientific groups, all the necessary equipment for doing a top class research.

***The desired impact of the proposed project on your career and your mid-term career goals:***

Working on the gate reflectometry as a spin qubit readout system will involve gaining knowledge in high frequency signal components (amplifiers, filters, attenuators, coaxial cables) and high frequency circuit design and COMSOL simulations maybe. Current movement of scaling up qubits puts a big emphasis on the “scale up friendly” readout system of individual qubits. With a knowledge gained from design of the gate reflectometry readout system I hope I can be a good candidate to continue my work in this emerging area of quantum computation.

If the gate reflectometry proves to be very sensitive as we expect, this would enable my group and me to do a good experiment with the silicon germanium nanowire based double quantum dot qubit. Good experiments mean to achieve high values for qubit quality criteria in respect to the other proposed spin qubits. Namely, those criteria are the spin relaxation time T1, the spin dephasing time T2\*, the spin echo T2ECHO  time and the CPMG T2CPMG time.