

Topic title	Frustration effects in molecular quantum simulations
Main host institution	Rudjer Boskovic Institute (RBI), Zagreb, Croatia https://www.irb.hr/eng
Supervisor	Dr. Fabio Franchini, RBI, Croatia Fabio.Franchini@irb.hr
Co-Supervisor	Prof. Guido Pupillo, Strasbourg University, France pupillo@unistra.fr
Mentor¹	Dr. Tomaz Prosen, Ljubljana University, Slovenia tomaz.prosen@fmf.uni-lj.si
Secondment institutions	University of Ljubljana, Slovenia (3 Months), BOSCH, Germany (3 Months)
Preferred starting date	February 2021
Topic description	
<p>The term frustration means that in certain systems it is impossible to minimize all energy constraints at once. However, typically it refers to an incompatibility between the local order promoted by the Hamiltonian and global/non-local constraints. This conflict often results in phenomenologies which differ dramatically from the non-frustrated cases.</p> <p>In this project, the candidate will analyze these effects in molecular systems, in which, from one side, the finite size of the molecule is important, and from the other, often long-range interactions cannot be discarded and introduce new forms of frustration.</p> <p>The analysis will be theoretical, employing a mixture of analytical and numerical techniques, and will involve a continue exchange of ideas and input from the rest of the Molecular Quantum Simulations network, to better define the systems to consider and tailor the objectives.</p> <p>In short, the goals are to analyze the effects of frustration due to non-local interactions in molecular Hamiltonians, and to identify the relevant degrees of freedom most suitable for quantum.</p>	
Recommended applicant's profile	
<p>The applicant must have recently acquired a master in the field of physics, preferably with expertise in quantum many-body physics and statistical physics. The successful completion of this project requires the mastery of advanced analytical techniques in quantum physics, aided by a certain amount of numerical simulations. Familiarity with both approaches is expected and willingness to learn and to tackle complicated problems is assumed.</p> <p>Enrollment for PhD studies at University of Strasbourg, France with occasional travel.</p>	

¹ Mentor: The primary role of the mentors will be to identify and facilitate specific training objectives, advise on any problems faced by the ESR, including career matters with an external perspective and provide mediation in the case of disputes.