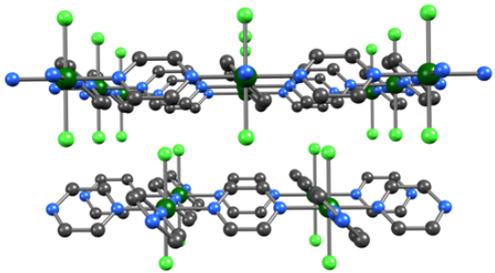


**CHEMISTRY MASTER - M2**  
**INTERNSHIP 2020-2021 (end of January – end of June)**

Options of Master (please tick the box(es) of the training that fits the field of the internship) :  
**MA (Advanced Materials)  - COSV (Organic Chemistry and Life Sciences)**   
**MMF (Functional Molecules and Macromolecules)**   
**PCCP (Physical Chemistry and Chemical Physics)**

<b>TITLE</b>	<b>Advanced 2D materials by metal-organic framework engineering</b>
<b>SUBJECT</b>	<p>Two-dimensional (2D) materials, i.e. materials that exhibit covalent chemical bonding in only one spatial plane like graphene or purely inorganic 2D chalcogenides, are presently at the forefront of fundamental and applied research. However, these purely inorganic materials, yet structurally simple, leave hardly any possibility for tailoring their electronic, magnetic or optical properties for specific applications. The use of Coordination Chemistry to design 2D materials is a very promising synthetic approach offering almost endless possibilities for the tuning of the physical properties, thus allowing to get a deeper understanding into complex physical phenomena in solid-state materials. The M<sub>3</sub> group at the CRPP has recently demonstrated that exciting features appear in Cr(pyrazine)<sub>2</sub>Cl<sub>2</sub> (Figure below), a 2D coordination “polymer” that belongs to the above-mentioned family of compounds (<i>Nat. Chem.</i> (2018), 10, 1056). Strong magnetic interactions between the spin carriers result in ferrimagnetic order below 55 K, while a remarkably high electrical conductivity (for a 2D coordination “polymer”) is observed at room temperature (32 mS cm<sup>-1</sup>) due to the electron delocalization within the Cr(pyrazine)<sub>2</sub>Cl<sub>2</sub> layer. As a continuation of the work done in the Cr(pyrazine)<sub>2</sub>Cl<sub>2</sub> system, this project will be devoted to the design and synthesis of new 2D systems that feature coexistent charge transport and magnetism pertinent to two spatial dimensions.</p> <div style="display: flex; align-items: center; justify-content: center;">  <div style="margin-left: 20px;"> <p><i>Figure</i> Perspective view of the 2D structure of Cr(pyrazine)<sub>2</sub>Cl<sub>2</sub>. Colour code: dark green, Cr; light green, Cl; blue, N; dark grey, C. H atoms have been omitted for clarity.</p> </div> </div>
<b>TECHNIQUES USED</b>	<p>Synthesis: Organic &amp; coordination chemistry; crystallization if necessary.            Characterizations: IR, UV, NMR spectroscopies; cyclic voltammetry, X-ray diffraction (single-crystal &amp; powder); magnetic susceptibility, optical and photomagnetic, calorimetric measurements...</p> <p>This internship will take place inside a multi-nationality team. Therefore, good knowledge in <b>English</b> will facilitate the communication with the other group members.</p>
<b>HOST LABORATORY</b>	Centre de Recherche Paul Pascal – UMR 5031
<b>TEAM</b>	Molecular Materials & Magnetism (M <sub>3</sub> - CRPP)
<b>SCIENTIFIC DIRECTOR</b>	<p>Name: Rodolphe Clérac            Tel: 06 03 51 74 16      eMail: clerac@crpp-bordeaux.cnrs.fr            Address: 115 avenue Dr. Albert Schweitzer, 33600 Pessac – France</p>
<p><b>Possibility to pursue the internship until the end of JULY: YES <input checked="" type="checkbox"/> / NO <input type="checkbox"/></b></p> <p><b>Possibility to offer the internship to a M1 if not attributed to a M2: YES <input checked="" type="checkbox"/> / NO <input type="checkbox"/></b></p>	