Master class with Maria Chudnovsky

April 25th, 15:00-17:00, room 26-00/101

Short presentations by PhD students or post-docs. Each presentation is followed by an open discussion with Maria Chudnovsky.

- **Ngoc Khang Le** (Laboratoire de l'Informatique du Parallélisme - ENS Lyon)
  - **Title:** Coloring even-hole-free graphs with no star cutset.
  - **Abstract:** A hole is a chordless cycle of length at least 4. A graph is called even-hole-free if it does not contain a hole of even length as an induced subgraph. The complexity status of coloring even-hole-free graphs remains open. However, some subclasses of even-hole-free graphs are known to be colorable in polynomial time like: (diamond, even-hole)-free graphs, (cap, even-hole)-free graphs, (pan, even-hole)-free graphs, ... We consider the class of even-hole-free graphs with no star cutset. In this talk, we give the optimal upper bound for the chromatic number and present a polynomial-time coloring algorithm for this class.

- **William Lochet** (projet COATI (Inria Sophia Antipolis - Méditerranée and I3S) and Laboratoire de l'Informatique du Parallélisme (ENS Lyon))
  - **Title:** A proof of the Erdos-Sands-Sauer-Woodrow conjecture.
  - **Abstract:** In 1982, Erdos, Sands, Sauer and Woodrow conjectured the existence of a function f, such that every tournament whose arcs are coloured with k colours has a set S of $f(k)$ vertices with the property that every vertex y outside of S has a monochromatic directed path from S to y. I will present a proof of this conjecture after explaining how it can be used to give a proof a of nice result of Barany and Lehel about covering points in R^d with a finite number of boxes.
    Joint work with Nicolas Bousquet and Stéphan Thomassé.

- **Nicolas Gastineau** (Lamsade - Université Paris-Dauphine)
  - **Title:** Some problems about Packing coloring.
  - **Abstract:** An i-packing is a subset X_i of vertices such that any two vertices u and v satisfy $d(u, v) > i$ (where $d(u, v)$ is the distance between u and v). The packing chromatic number is the smallest integer such that there exist k sets of vertices $X_1, ..., X_k$ forming a partition of the vertex set of a graph, X_i being an i-packing. In this talk, I will first present decision problems about the existence of i-packings and about the packing chromatic number. Afterwards, I will present conjectures about graphs having bounded packing chromatic number.

- **Carl Feghali** (Institut de Recherche en Informatique Fondamentale - Université Paris Diderot)
  - **Title:** Reconfigurations of Colorings of Graphs.
  - **Abstract:** There is a wealth of results concerned with the chromatic number of graphs. These results can be naturally complemented with what is known as coloring reconfiguration problems, where one is concerned with how "far apart" two colorings of a graph are from each other. Results in the reconfiguration setting can, in turn, provide further insight into questions concerned with the existence of colorings of graphs. For example, a result of Meyniel asserting that the 5-colorings of planar graphs are Kempe equivalent implies that a sequence of Kempe changes from a 5-coloring to a 4-coloring of a planar graph exists (so, in particular, Kempe's failed attempt at proving the four color theorem is not so hopeless after all). In this talk, I will survey some of the known results and open problems in this area (covering both single vertex recolorings and Kempe changes as notions of "far apart").

- **Mehdi Khosravian** (Lamsade - Université Paris-Dauphine)
  - **Title:** Positive and Negative Extension of graph problems.
  - **Abstract:** We consider a family of graph problems where feasible solutions are subsets of vertices and edges. We are interested in decision problems asking existence of minimal (resp., maximal with respect to inclusion) solutions which extend (resp., exclude) a specified subset. More formally, Positive extension (resp. Negative extension) of a p roblem Π consists, given instance $I = (X, \mathcal{X})$ where $\mathcal{X}$ denotes the feasible solutions and a subset $U \subseteq X$, in deciding if there exists a minimal (resp. maximal) feasible solution $S \in \mathcal{X}$ of I which $U \subseteq S$ (resp. $S \cap U = \emptyset$).

    In this work, we focus on several problems coming from graph theory such as Vertex Cover, Independent Set, Edge matching, k-edge connected Subgraph, H-free Subgraph etc. By using several reductions from SAT, we present **NP**-completeness proof for Positive or Negative extension versions of them. Also, by adapting Karp-reduction in the context of Positive and Negative extensions (called monotone reduction), we prove the **NP**-completeness of Positive extension of Feedback Vertex Set, Feedback Edge Set and Edge Dominating Set or Negative extension of Unique Connected Subgraph, etc.

    Finally, we complete the results by showing some parameterized complexity results: Positive extensions of Vertex Cover parameterized by $|U|$ is **W[1]**-complete while parameterized by the size of the maximum minimal vertex cover is in **FPT**. Moreover, we prove that Positive extensions of Dominating Set, Set Cover, Hitting Set, Edge Dominating Set and Feedback Vertex Set parameterized by $|U|$ are not in **FPT**.