## Matching Cuts in Graphs of High Girth and H-Free Graphs

Carl Feghali (ENS Lyon, France), Felicia Lucke (University of Fribourg, Switzerland), Daniël Paulusma (Durham University, United Kingdom), Bernard Ries\*(University of Fribourg, Switzerland)

The (PERFECT) MATCHING CUT problem is to decide if a connected graph has a (perfect) matching that is also an edge cut. The DISCONNECTED PERFECT MATCHING problem is to decide if a connected graph has a perfect matching that contains a matching cut. Both MATCHING CUT and DISCONNECTED PERFECT MATCHING are NP-complete for planar graphs of girth 5, whereas PERFECT MATCHING CUT is known to be NP-complete even for subcubic bipartite graphs of arbitrarily large fixed girth. We prove that MATCHING CUT and DISCONNECTED PERFECT MATCHING are also NP-complete for bipartite graphs of arbitrarily large fixed girth. We prove that MATCHING CUT resolves a 20-year old open problem. We also show that the more general problem d-CUT, for every fixed  $d \geq 1$ , is NP-complete for bipartite graphs of arbitrarily large fixed girth and bounded maximum degree. Furthermore, we show that MATCHING CUT, PERFECT MATCHING CUT and DISCONNECTED PERFECT MATCHING are NP-complete for H-free graphs whenever H contains a connected component with two vertices of degree at least 3. Keywords: matching cut, girth, induced subgraph, computational complexity