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Cycle Lengths in Graphs of Large Chromatic Number

In 2016, Brewster, McGuinness, Moore, and Noel conjectured that for $k \geq 3$, a graph with chromatic number greater than k must have at least as many cycles of length $0 \bmod k$ as the complete graph on $k+1$ vertices. We proved that the conjecture is true when $k = 3$, and that K_4 was the unique minimizer over all 4-critical graphs. This talk will explore three topics: our proof for the $k = 3$ case, a recent proof of the entire conjecture, and further directions that can and have been explored regarding this topic.