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Lauren Keough* (keoulaur@gvsu.edu) and **Darren Parker**. *An Extremal Question for the Lights Out Game*. Preliminary report.

The original lights out game is played on a $n \times n$ grid in which some vertices are “on” at the start of the game. When you toggle a vertex that vertex and all of its neighbors switch their on/off status. This game has been generalized in several ways including playing the game on general graphs and playing the colored version in which the labels come from \mathbb{Z}_k . In the colored version of the game toggling a vertex means that vertex and all adjacent vertices have their labels increased by 1 modulo k .

We say a graph is always winnable if for any initial labeling there exists a sequence of togglings that terminate with all vertices having the label 0. Clearly the complete graph on n vertices is not always winnable. We seek the maximum number of edges a graph on n vertices can have and be always winnable. We’ll answer this question in some cases using linear algebra techniques. (Received January 26, 2017)