

1152-05-55

**Galen Dorpalen-Barry, Cyrus Hettle, David C. Livingston, Jeremy L. Martin\***  
([jlmartin@ku.edu](mailto:jlmartin@ku.edu)), **George Nasr, Julianne Vega** and **Hays Whitlatch**. *A positivity phenomenon in Elser's Gaussian-cluster percolation model.*

Veit Elser proposed a random graph model for percolation in which physical dimension appears as a parameter. Studying this model combinatorially leads naturally to the consideration of numerical graph invariants which we call Elser numbers  $\text{els}_k(G)$ , where  $G$  is a connected graph and  $k$  a nonnegative integer. Elser had proven that  $\text{els}_1(G) = 0$  for all  $G$ . By interpreting the Elser numbers as Euler characteristics of appropriate simplicial complexes called nucleus complexes, we prove that for all graphs  $G$ , they are nonpositive when  $k = 0$  and nonnegative for  $k \geq 2$ . The last result confirms a conjecture of Elser. Furthermore, we give necessary and sufficient conditions, in terms of the 2-connected structure of  $G$  for the nonvanishing of the Elser numbers. (Received August 15, 2019)