[P19] Percolation and cluster properties in spatial evolutionary prisoner's dilemma game on two-dimensional lattices

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We investigate percolation and cluster properties of cooperator (C) and defector (D) in spatial evolutionary prisoner's dilemma game (SEPDG) on two-dimensional lattices. Percolation properties depend on both the lattice structure and the temptation factor b. On the hexagonal lattices, C (D) clusters undergo the percolation transition when $1 < b < 3/2$, whereas a D cluster always percolates regardless of the initial C density p_i^C. On the square lattices, when $1 < b < 4/3$ and $3/2 < b < 2$, percolation transitions occur. When $4/3 < b < 3/2$, a D cluster always percolates. On the triangular lattices, C clusters always percolate regardless of p_i^C when $1 < b < 5/4$. When $5/4 < b < 3/2$, the percolation transitions occur. D clusters always percolate when $3/2 < b < 2$. By finite size scaling analyses the universality classes of all the percolation transitions belong to that of the random (ordinary) percolation regardless of the lattice structure. We also explain how the specific percolation properties arise from the evolution mechanism of SEPDG on a given lattice.