Abstract: The origin of homochirality—the single handedness of biological amino acids and sugars—has been a topic of debate for over a century. There are many theoretical models describing potential scenarios for the origin of homochirality. However, it has not yet been possible to confirm if the requirements for homochirality from any of these models were satisfied during the emergence of life. We do however, expect that life would have started with nonequilibrium driven processes involving self-replication. Here, we show that in a nonequilibrium system of self-replicating chiral molecules, when the self-replication rate exceeds a calculated threshold, the population transitions to homochirality. This transition can be observed only in a model in which the probabilistic nature of the self-replication process is taken into account. Moreover, we show that the resulting homochirality is stable in spatially extended diffusive systems.

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