**Abstract**

We used a nonlinear electro-optic feedback loop based on a liquid crystal spatial light modulator (SLM) and a digital camera coupled to a numerical model to transmit and receive, encoded two-dimensional images by employing synchronization of spatiotemporal chaos.

**Lattice Synchronization**

\[ X_n(i,j) = \mathcal{F}[X_{n-1}(i,j)] \quad Y_n(i,j) = \mathcal{F}[(1 - c)Y_{n-1} + cX_{n-1}] \]

The rate and degree of synchrony vary greatly with coupling strength.

**Experiment**

The relationship between the phase shift and the intensity allows us to construct a nonlinear iterated map.

**Dynamics**

As the parameter ‘a’ changes from 0 to 1, the pixel follows a period doubling route to chaos.

\[ X_n(i,j) = \frac{1}{2} (1 + \cos(2\pi a X_{n-1}(i,j))) \]

By coupling these pixels together in different ways, we were able to achieve diverse dynamical behaviors.

The SLM-based feedback ring allows for a straightforward implementation of arbitrary coupling schemes. It is a versatile testbed for the effects of network topology in systems consisting of a large number of coupled iterated maps.

**Coupling Schemes**

The pixels were coupled in two ways.

- 8 nearest neighbors (bidirectional)
- 4 nearest neighbors (bidirectional) and random distant links (uni- and bidirectional) to non-adjacent pixels

**Experiment-Model Synchronization**

Adding random distant links dramatically affects synchronization between two lattices.

**Distant Links**

Parameters: \( c = 0.7 \), \( a = 0.85 \), \( \varepsilon = 1 \), 32x32 grid