

Chaotic Communications with Mutually Coupled Ring Lasers



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Nonlinear Dynamics in Optical Systems

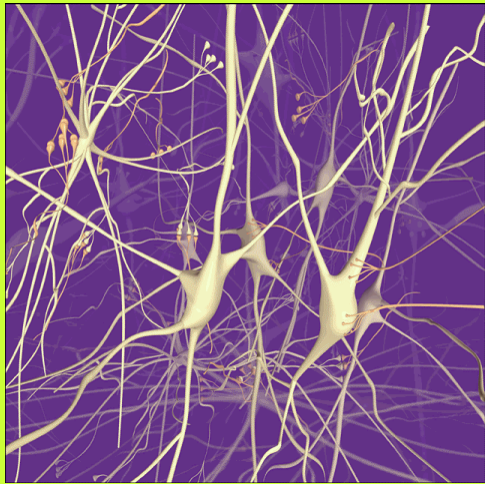
Institute for Research in Electronics & Applied Physics

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Some Definitions...

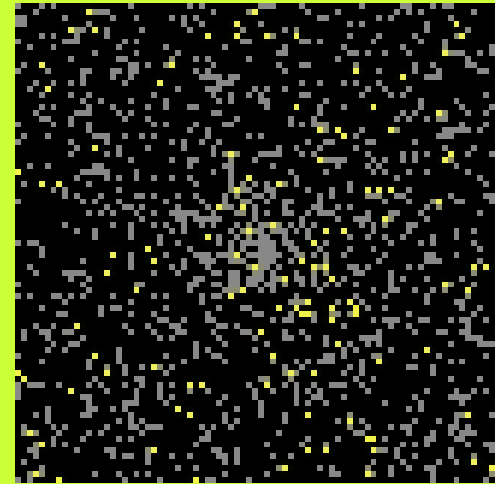
Synchronization:

process in which
similar systems come to
share identical
behavior

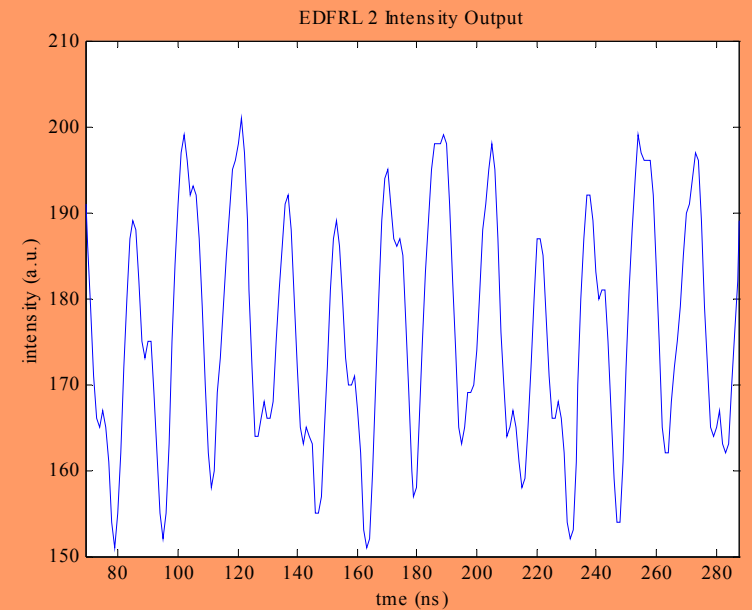
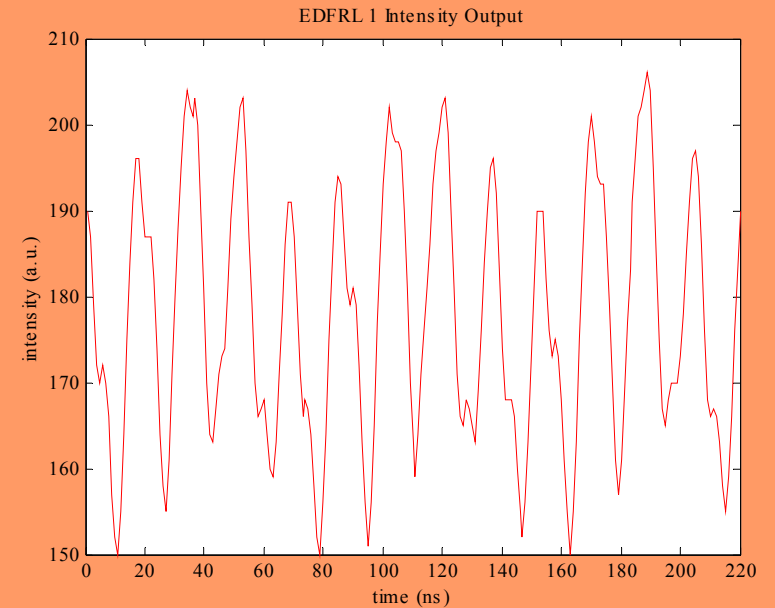
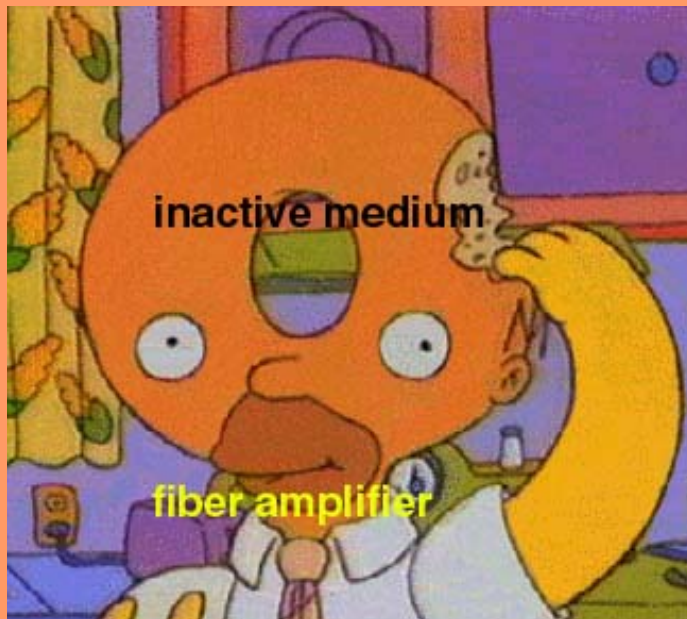
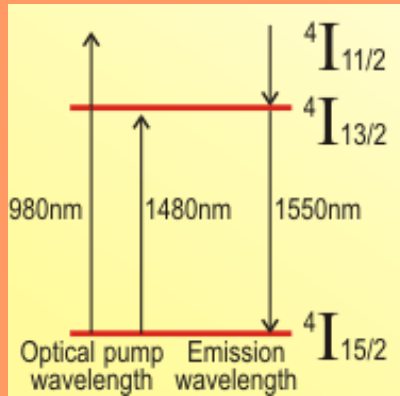


Mutual Coupling:

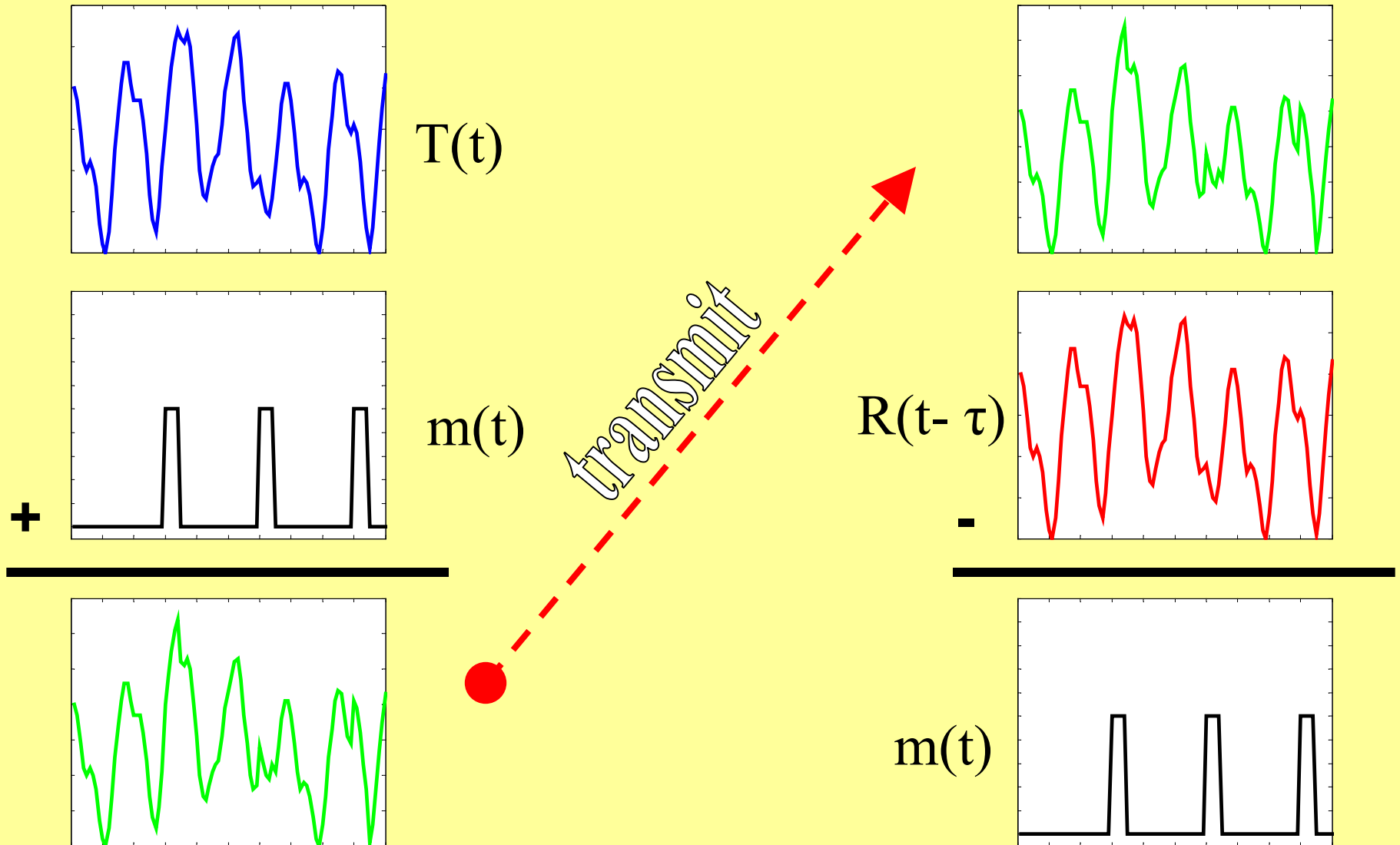
two or more systems
influence the dynamics
of one another



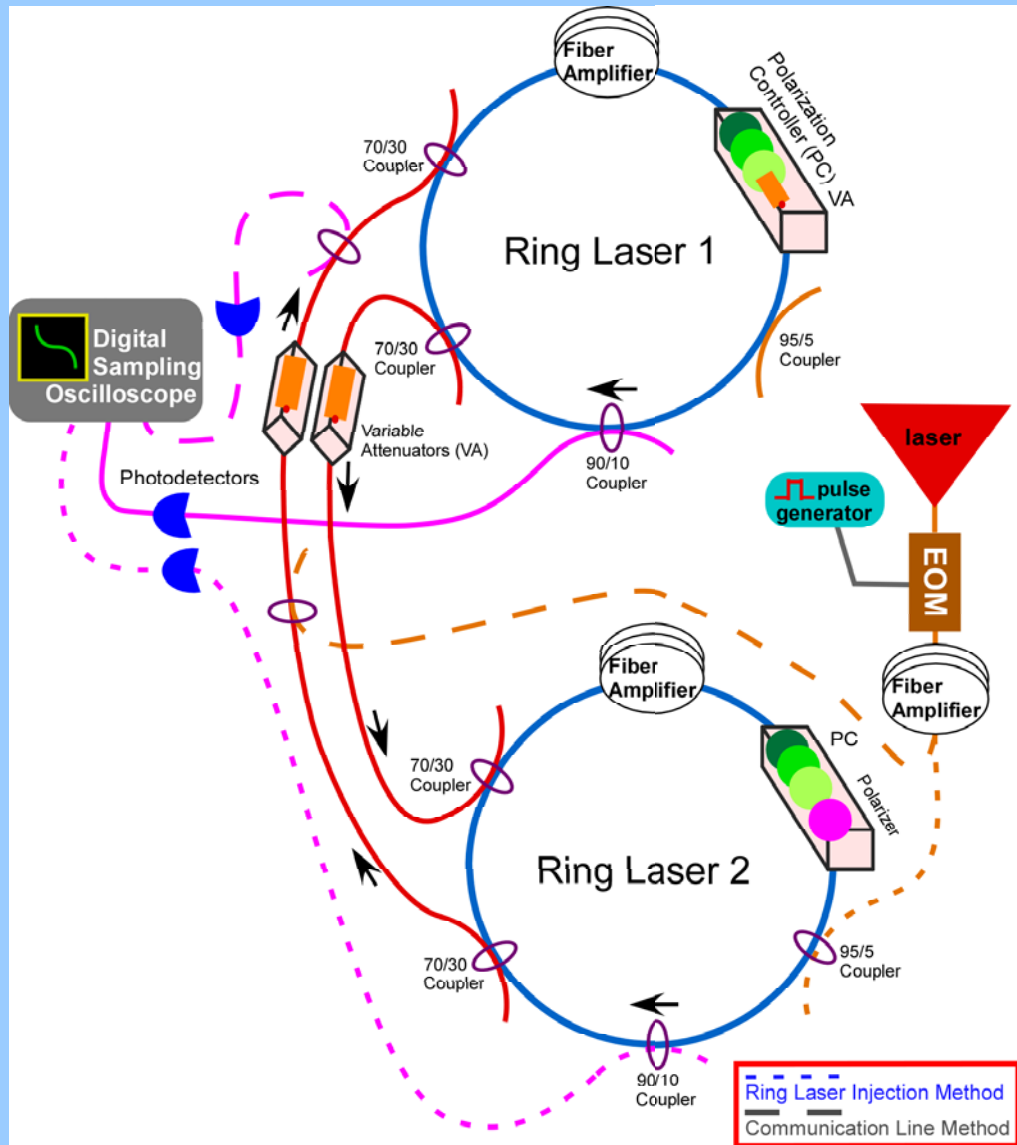
Erbium-Doped Fiber Ring Lasers



Communication Scheme Idealization



Communication Method



Tunable Laser

Programmable Function Generator

Electro-optic Modulator

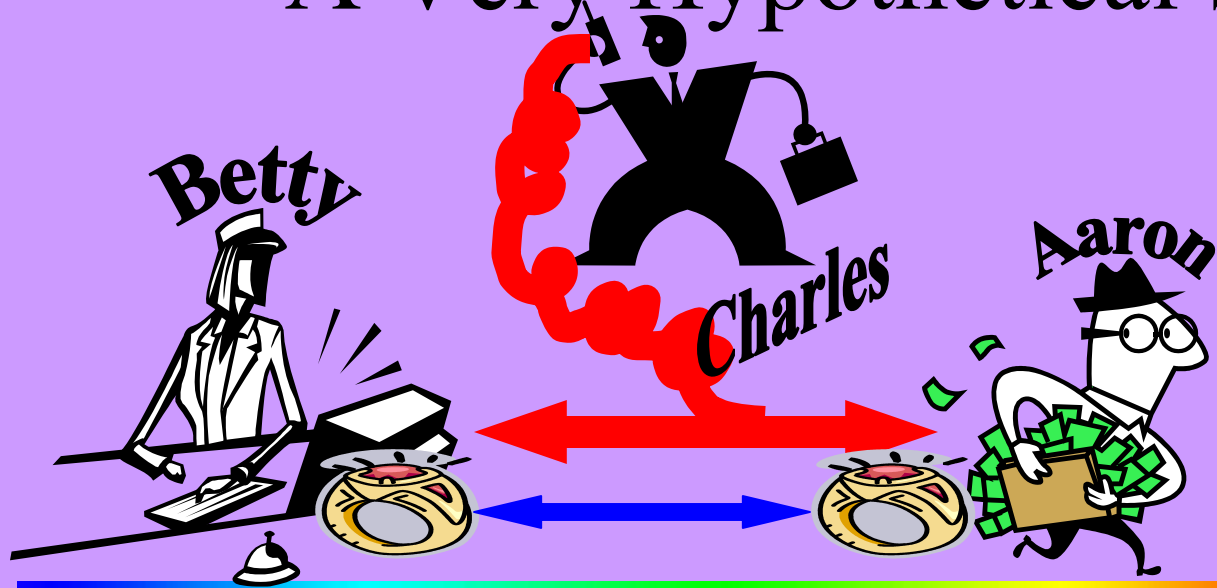
Couplers

Photoreceivers

Oscilloscope

MATLAB

A Very Hypothetical Situation



AMSC

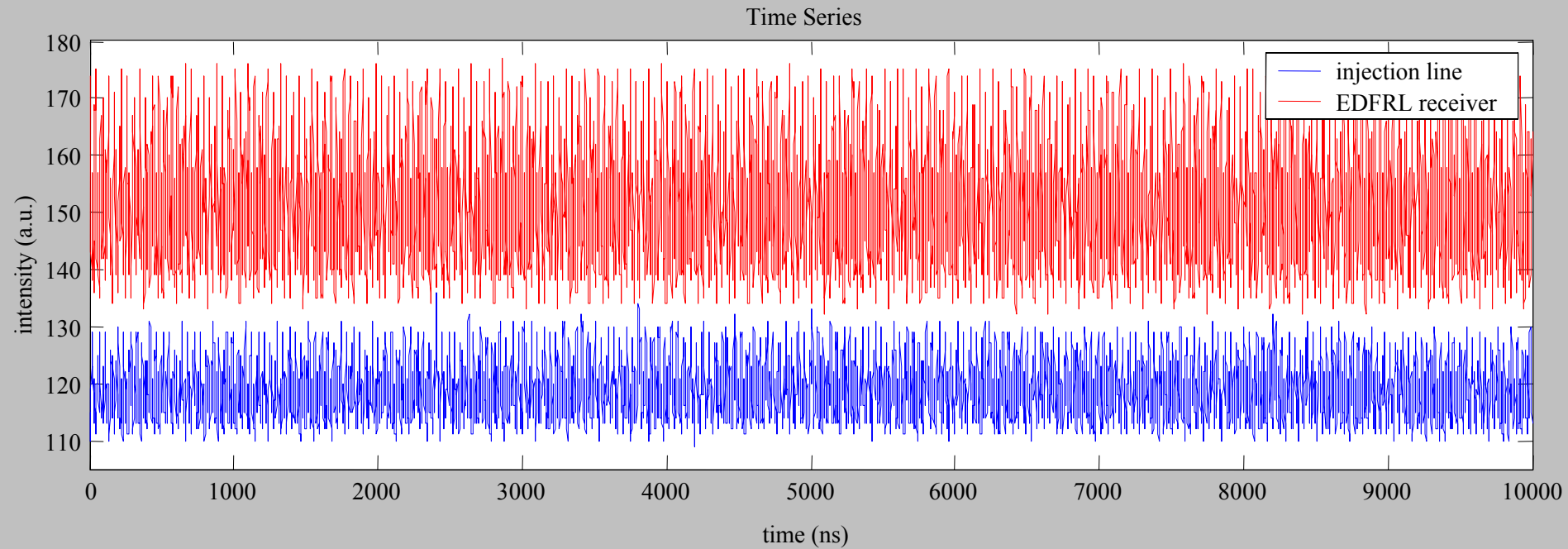
ISR

IPST

IREAP

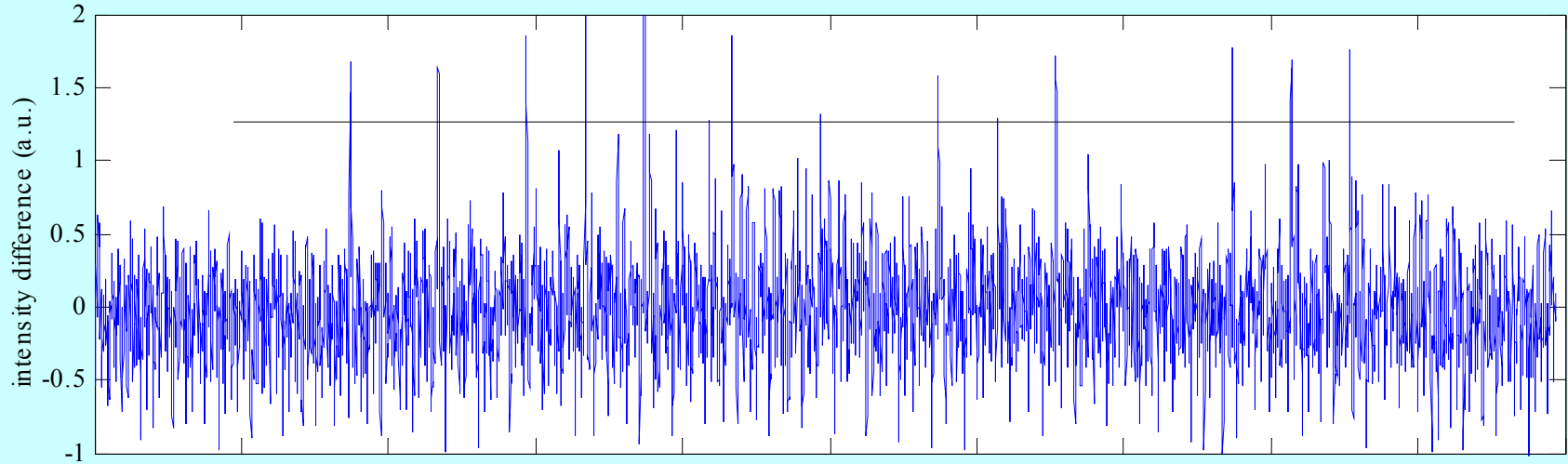


Time Series

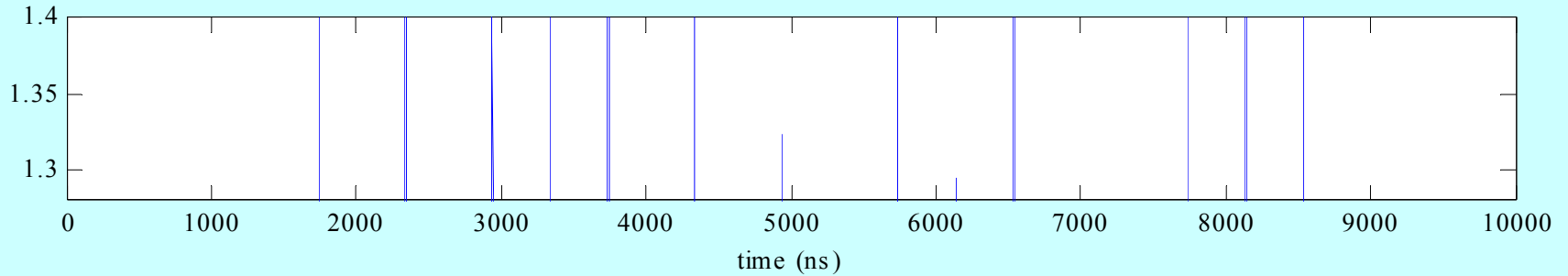


Message Recovery

Time Series Difference with Time Delay Adjustment



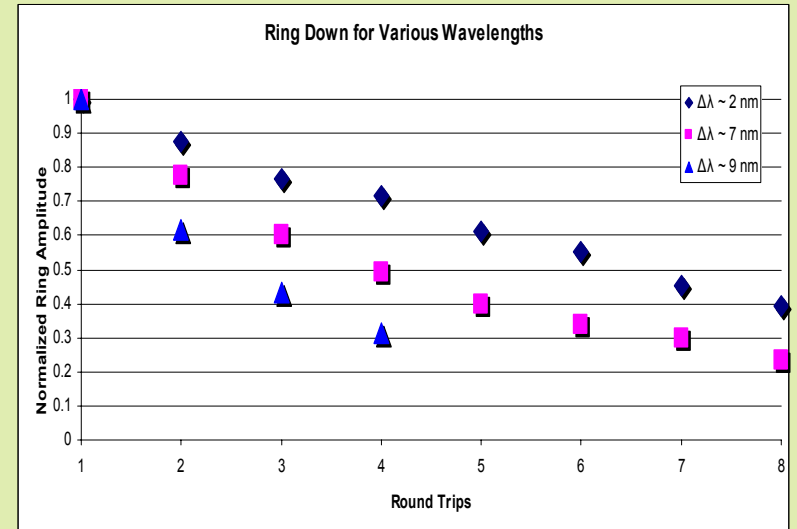
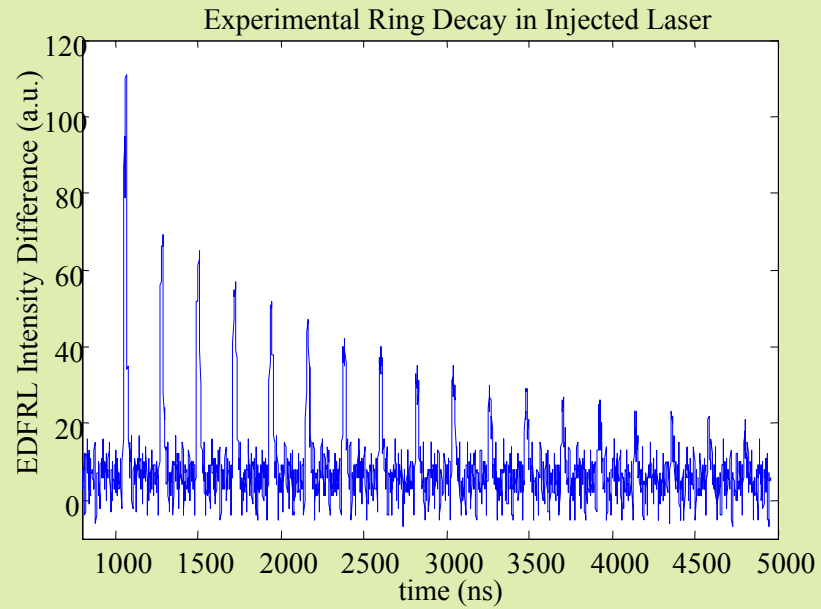
Zoomed Difference



01001001 01010010 01000101 01000001 01010000

IREAP

Ringing



Conclusions

- Synchronization between ring lasers is easier to achieve when mutual coupling, rather than one-way coupling, is employed.
- Synchrony between mutually coupled systems is robust.
- Message encryption and decryption is a viable application of mutually coupled EDFRL systems.
- The threshold for message recovery is the same as the threshold for synchronization.