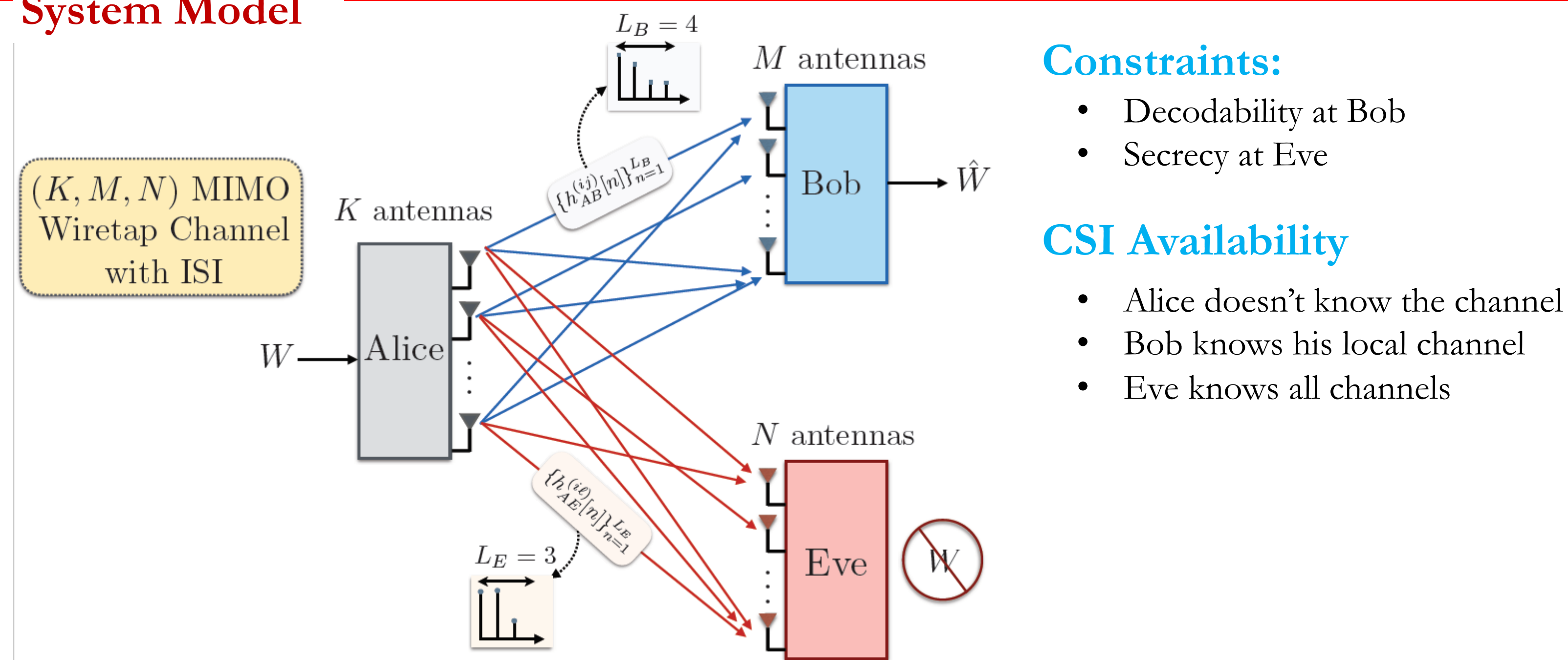


MIMO Wiretap Channel with ISI Heterogeneity

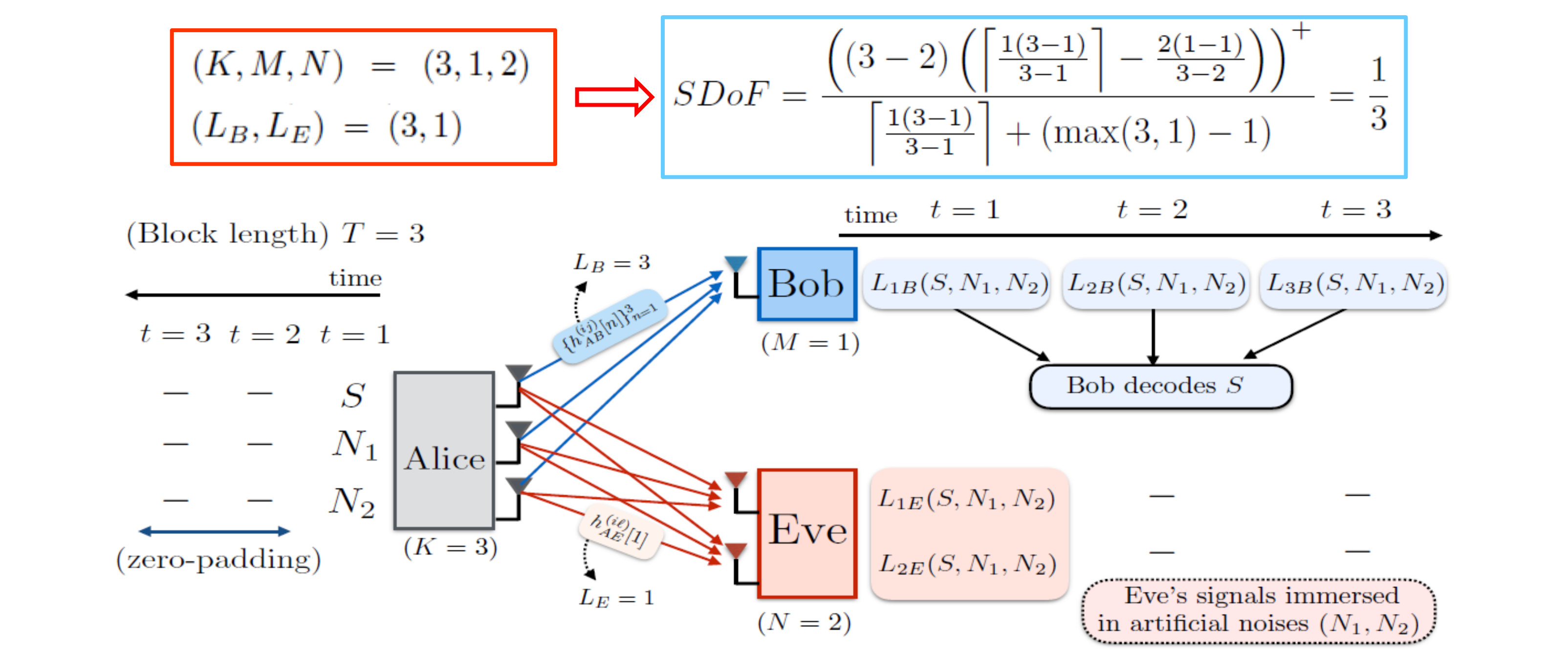
Main problems to address:

- Channel state information at the transmitters (CSIT) is useful for secure communication.
- CSIT may not be obtainable, especially from the eavesdroppers.
- Can we exploit intersymbol interference (ISI) heterogeneity to achieve positive secure degrees of freedom (SDoF)?

System Model



Example



Main Result

Theorem:

For the (K, M, N) MIMO wiretap channel without any CSIT and with effective ISI channels of CIR lengths L_B and L_E for Bob and Eve, the following SDof is achievable

$$SDoF = \frac{\left((K - N) \left(\left\lceil \frac{M(L_B - 1)}{K - M} \right\rceil - \frac{N(L_E - 1)}{K - N} \right) \right)^+}{\left\lceil \frac{M(L_B - 1)}{K - M} \right\rceil + (\max(L_B, L_E) - 1)}$$

References

- [1] J. d. D. Mutangana, D. Kumar, and R. Tandon, "MIMO Wiretap Channel with ISI Heterogeneity - Achieving Positive Secure DoF," Asilomar Conference on Signals, Systems, and Computers, 2017.
- [2] J. d. D. Mutangana, R. Tandon, and N. Lee, "Blind Cooperative Jamming: Exploiting ISI Heterogeneity to Achieve Positive Secure DoF," Global Communications Conference (GLOBECOM), 2017.
- [3] J. d. D. Mutangana and R. Tandon, "Interference Channels with Confidential Messages: Scaling up the Secure Degrees of Freedom with No CSIT," Asilomar Conference on Signals, Systems, and Computers, 2018.
- [4] J. d. D. Mutangana and R. Tandon, "Interference Channels with Confidential Messages: Leveraging OFDM Transmission to Scale up Secure Degrees of Freedom with No CSIT," International Symposium on Information Theory (ISIT), 2019.
- [5] J. d. D. Mutangana and R. Tandon, "Blind MIMO Cooperative Jamming: Secrecy via ISI Heterogeneity Without CSIT," IEEE Transactions on Information Forensics and Security, IEEE Transactions on Information Forensics and Security (TIFS), 2020.
- [6] M. Seif, R. Tandon, and M. Li, "On the Secure Degrees of Freedom of the K-user Interference Channel with Delayed CSIT," IEEE International Symposium on Information Theory (ISIT) 2018.
- [7] M. Seif, R. Tandon and M. Li, "On the Secure Degrees of Freedom of $2 \times 2 \times 2$ Multi-Hop Network with Untrusted Relays," IEEE International Conference on Communications (ICC 2018, Communication Theory Symposium), 2018.

Interference Channel with Delayed CSIT

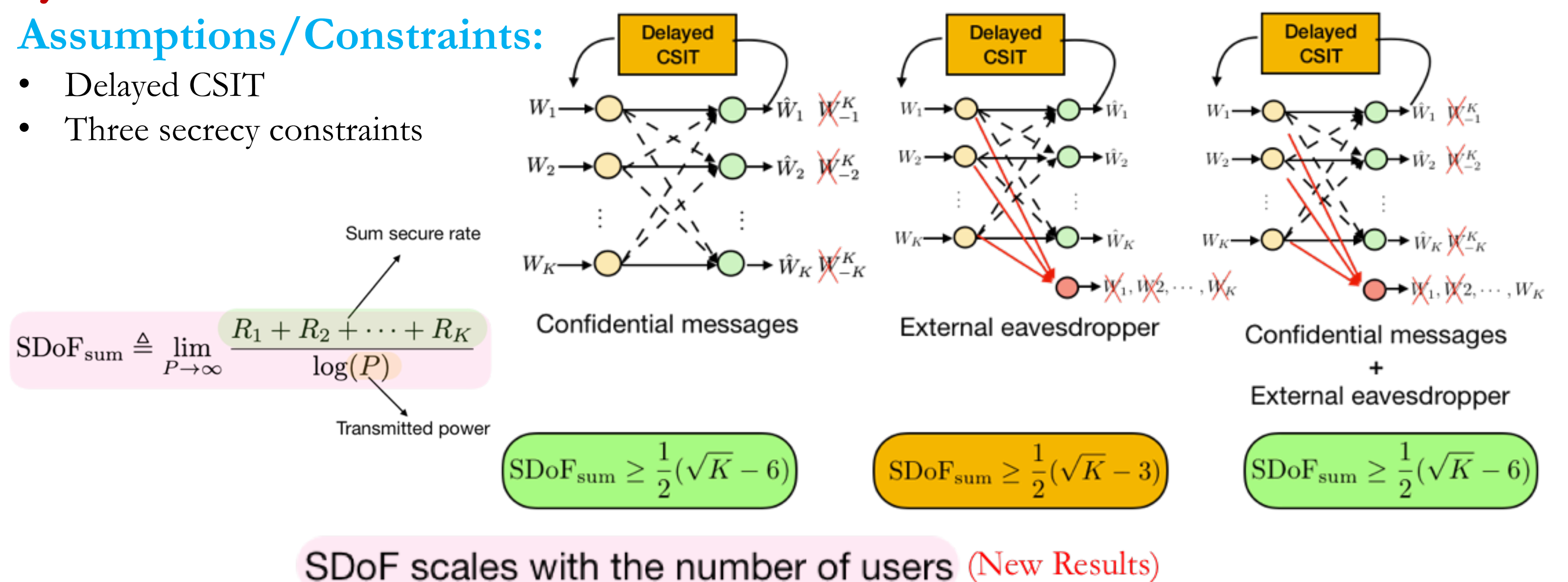
Main problems to address:

- Having instantaneous CSIT is challenging in practice
- Is there any positive SDof for the interference channel with delayed CSIT?
- Does SDof scale with the number of users with delayed CSIT?

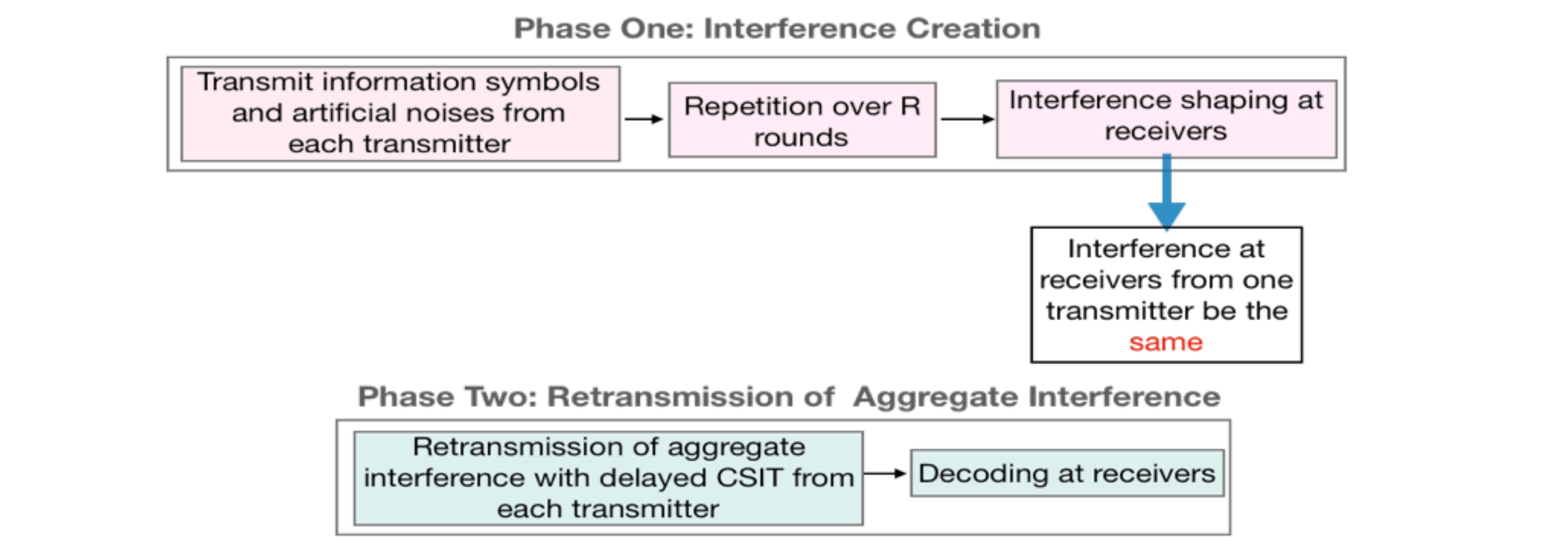
System Model

Assumptions/Constraints:

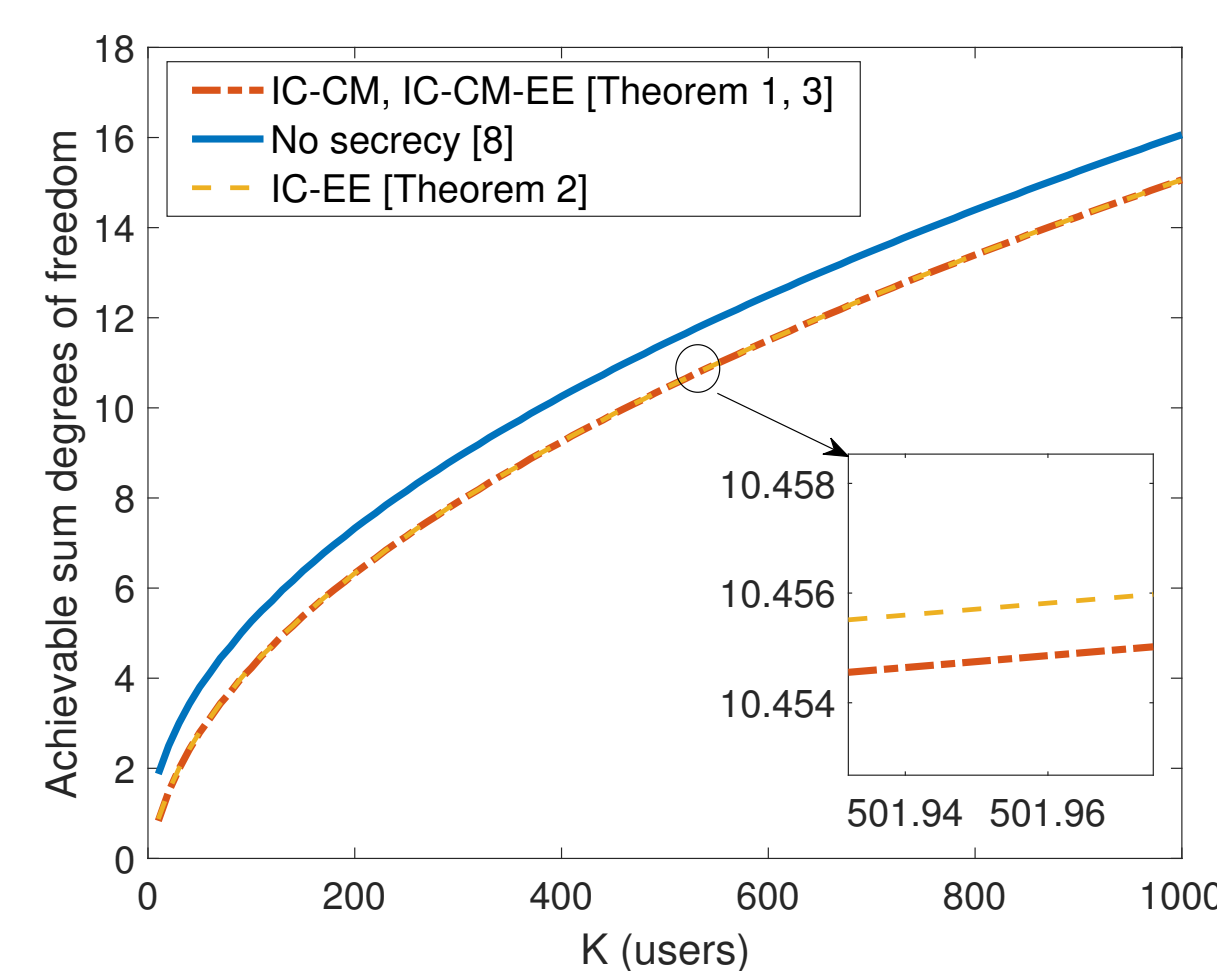
- Delayed CSIT
- Three secrecy constraints



Our Scheme in A Nutshell



Summary of Results



	Perfect CSIT	Delayed CSIT	No CSIT
No Secrecy	$\frac{K}{2}$	$> \frac{1}{2}(\sqrt{K} - 1)$	1
Confidential Messages	$\frac{K(K-1)}{2K-1}$	$> \frac{1}{2}(\sqrt{K} - 6)$	0
External Eavesdropper	$\frac{K(K-1)}{2K-1}$	$> \frac{1}{2}(\sqrt{K} - 3)$	0
Confidential Messages and Eavesdropper	$\frac{K(K-1)}{2K-1}$	$> \frac{1}{2}(\sqrt{K} - 6)$	0