

## Elektrotechnik-Elektronik-Informationstechnik

# EEI KOLLOQUIUM

### Information-Theoretic Limits of Intensity-Modulation Direct-Detection Multi-user Channels

**Dr.-Ing. Anas Chaaban**

King Abdullah University of Science & Technology, Thuwal, Saudiarabien

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**Diskussionsleitung: Prof. Dr.-Ing. R. Müller**

Intensity-Modulation Direct-Detection (IM-DD) is a simple and practical transmission scheme that is of importance in Optical Wireless Communications (OWC). OWC has witnessed a revival in the last decade due to its potential indoors and outdoors applications, such as Light-Fidelity (LiFi) systems and Free-Space Optical (FSO) backhaul. FSO is mostly a point-to-point communication technique, which has been intensively studied in the literature. On the other hand, the potential of LiFi consists in being able to support multi-user communication. The capacity of the underlying IM-DD multi-user channel has not been studied in the literature. Although classical information-theoretic results on the capacity of multi-user discrete-memoryless channels apply, the evaluation of such results is cumbersome in the IM-DD context. Computable results are important since they are generally more insightful. This presentation focuses on this subject. The capacity of the IM-DD broadcast channel and multiple access channel are studied. Computable capacity bounds are derived and asymptotic capacity results are established. We show that a truncated Gaussian input distribution is nearly optimal at high SNR, while coded On-Off Keying (OOK) is optimal at low SNR. We also consider the parallel IM-DD channel and provide a simple 'intensity' allocation algorithm which is nearly optimal. The presentation also highlights some interesting open problems for future work.