**Mobility spectrum analysis of carrier transport in semiconductors:**
**Is it necessary and who cares?**

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Modern semiconductor MIS and multi-layer heterostructures can contain multiple populations of distinct carrier species, which can be either intentional or unintentional. Accurate characterization of electronic transport properties in such structures demands a more sophisticated methodology than the conventional analysis of Hall-effect measurements at a single value of magnetic field intensity. This difficulty can be overcome by undertaking variable magnetic field Hall measurements combined with mobility spectrum analysis (MSA), as originally proposed by Beck and Anderson in 1988. Over the past three decades, numerous research groups have developed sophisticated algorithms built upon the original MSA framework, including the commercially-available quantitative mobility spectrum analysis (QMSA), various implementations of maximum-entropy MSA, and the recently developed high-resolution MSA procedure (HR-MSA).

This presentation will discuss the result of MSA-based studies of electronic transport in various semiconductor HEMT, MIS and multi-layer heterostructures, including recent progress in the modelling of mobility distributions and carrier scattering in the two-dimensional electron gas of AlGaN/GaN HEMTs. It is shown that the HR-MSA approach can provide unique information regarding multi-band conduction, *e.g.* due to light and heavy holes, and that it enables optimization of the epitaxial growth process, since it allows the identification of parasitic conduction channels as well as the separation of substrate conduction mechanisms from those associated with the grown epilayer. Furthermore, since HR-MSA is able to provide unique information on mobility *distributions* for each individual carrier, it is capable of providing greater insight into the fundamental scattering mechanism and electronic transport phenomena in two-dimensional inversion and accumulation layers as well as "bulk" carriers.