Bubbles on the cutting edge or how to intensify bubble column reactors
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In this lecture, I will explain our philosophy for modelling multiphase flow systems. In essentially every multiphase flow system we deal with a very large range of time and length scales, which cannot be resolved by a single universal model. For this reason, we apply a multiscale modelling strategy, where small scale direct numerical simulation models are used to develop closure equations that are required to close coarse grained models. The latter can be applied at larger scales, and can be characterized as Lagrangian or Eulerian types of models, where individual particles, droplets and/or bubbles are tracked individually, or their locally averaged motion is tracked. I will illustrate our multiscale strategy with one application example: an bubble column with micro-structuring to intensify the gas-liquid contact. I will show simulation and modeling results at different scales. All models are validated against experimental data that we obtain with state-of-the-art multiphase measurement techniques.