In this project we want to continue the development and analysis of a compressible phase field model for liquid vapor flow. We are interested in the numerical treatment of this model and in the mathematical properties, especially in the sharp interface limes.
The starting point for our modeling is given by G. Witterstein, who has given general framework of phase field models which are thermodynamically consistent and are proven to fulfill the desired interface conditions in the sharp interface limit achieved by a matched asymptotic expansion.
Our goals in this period are to gain better insight into the physical properties of this models, especially that is to find equations of state which correctly describe the behavior of liquid-vapor flow for water. As the framework of Witterstein provides an isothermal approach, the incorporation of temperature dependent effects is another goal we want to complete during the time of this project. These models will be tested in numerical simulations, using a compressible Navier-Stokes solver coupled with the phase field equations using a Local-Dicontinuous-Galerkin method up to order 4 in space and time and if necessary adapt the numerical code to these new models and extend our existing flow solver.
On the analytical side we are interested in a more rigorous justification of the sharp interface limes and the investigation of jump conditions at the interface. Here we want to use the methods and results found given by Kroener et al.