**Motivation**

**Modelling Non-Equilibrium**
- Limits of thermodynamic equilibrium assumption → confidence in existing models
- Being able to model situation of clear non-equilibrium → extending range of applicability

**Current Work**

**Thermal Non-Equilibrium**

\[
\frac{\partial (\phi \psi S_v h_v + \sum \psi S_i h_i)}{\partial t} = - \nabla \cdot (\nabla (\phi \psi S_v h_v) + \sum \nabla h_i)
\]

**Volume changing work**

\[
\frac{\partial}{\partial t} \left( \psi (1 - \phi) h_v \nabla T_v \right) = - \nabla \cdot (\nabla h_v \nabla T_v) + \phi \psi \rho_v \frac{\partial T_v}{\partial t} + \frac{\partial \psi}{\partial t} + \frac{\partial h_v}{\partial t} + q_{	ext{thermodynamic}}
\]

**Visualization of Temperature in Micro model**
- There are existing Micro models.
- How to measure temperature distribution?

**Sensitivity Analysis**
- Many new parameters are in the model
- How to find out which one needs most attention?

**Scenarios**
- Up to now rather academic examples have been simulated.
- Ideas for more realistic setting welcomed!

**Indicators**
- It would be nice to know when a model is leaving its range of validity
- As little limitations / assumptions should go into the development of theses indicators

**Outlook**

**Identify Need for Complex Model**
- Under which circumstances is thermodynamic equilibrium a good assumption?
- Sensitivity Analysis: Which Parameters / choices have most influence?