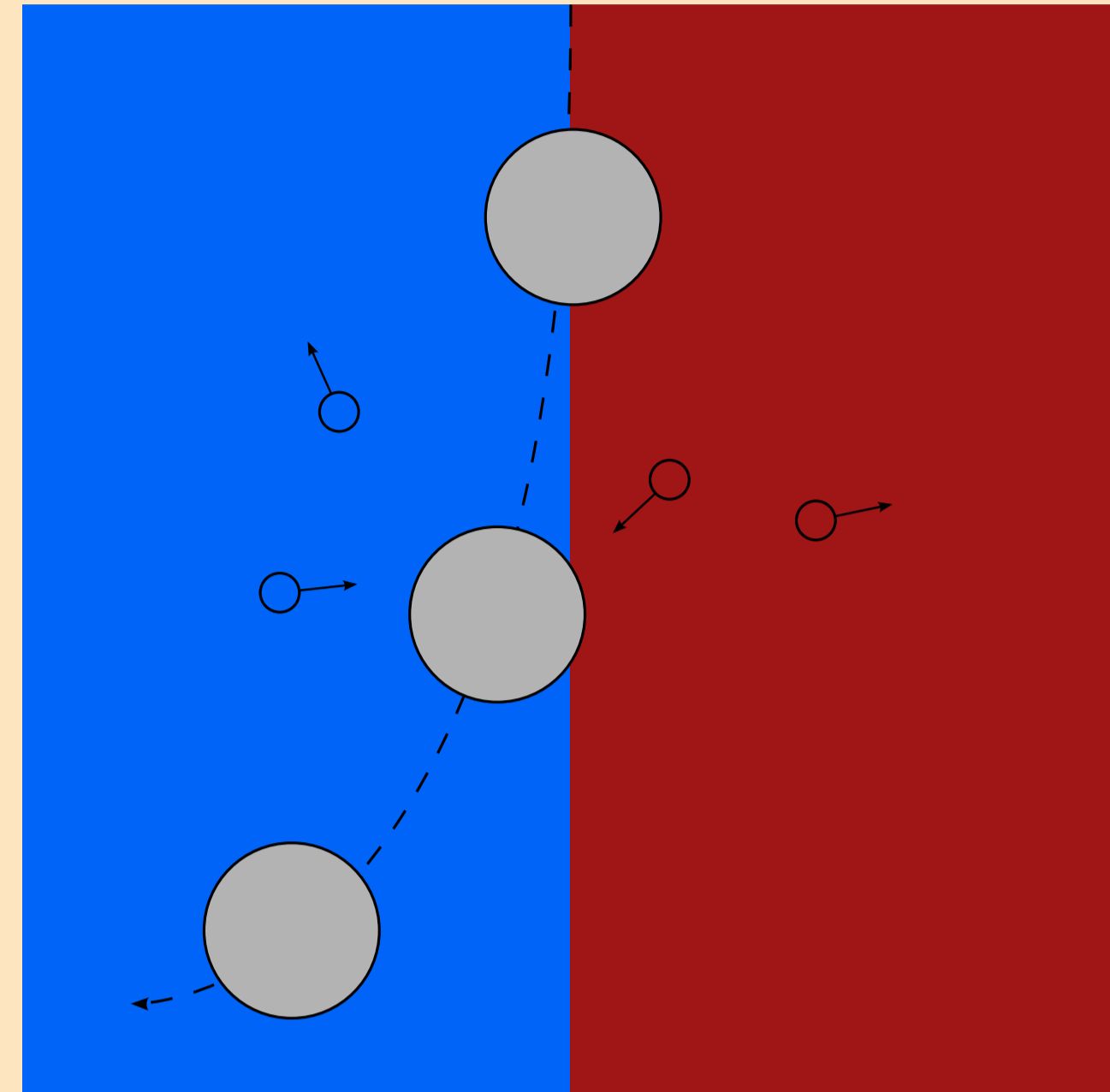


# Multiscale Modeling and Simulation

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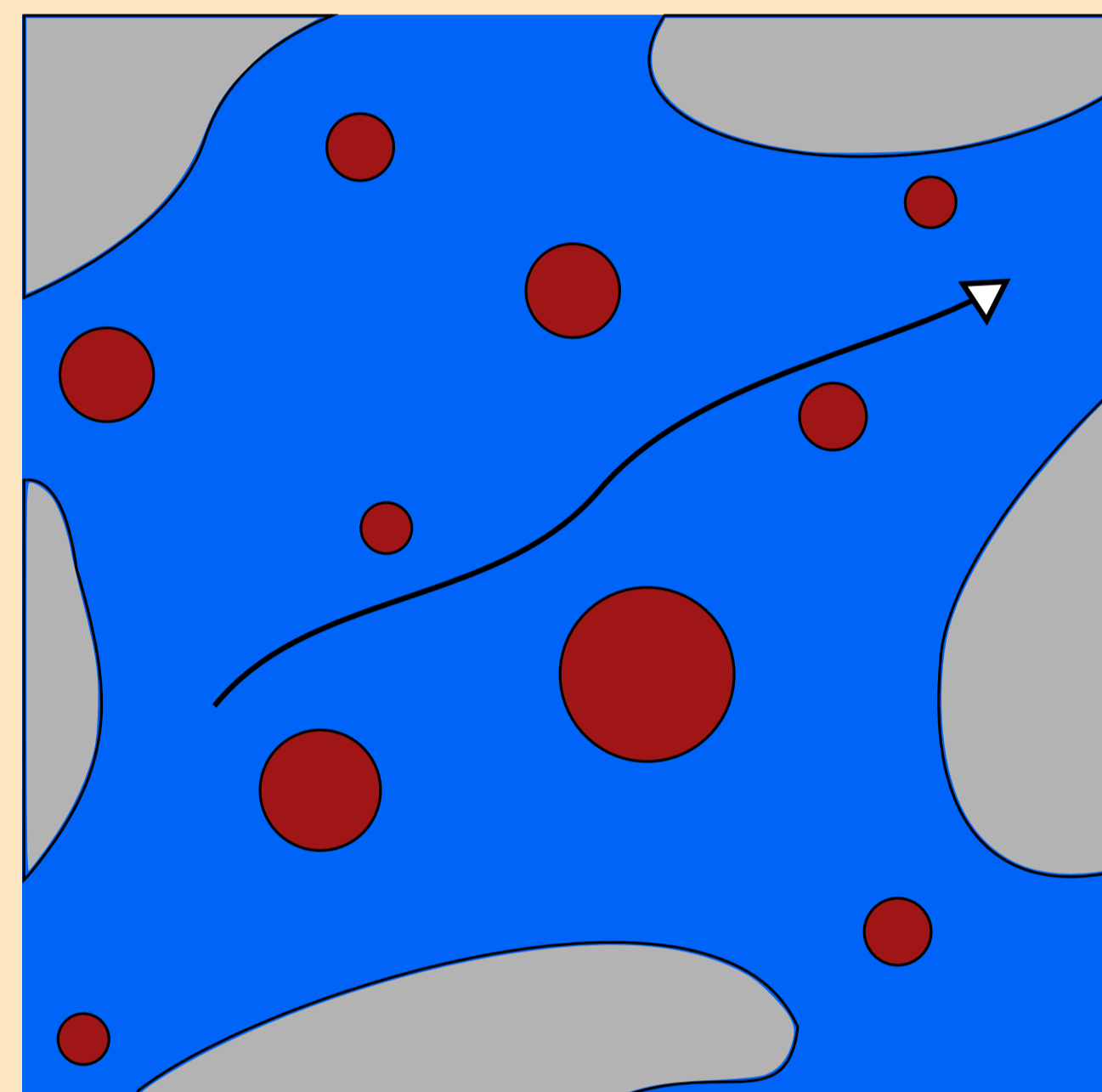
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## Thermophoresis



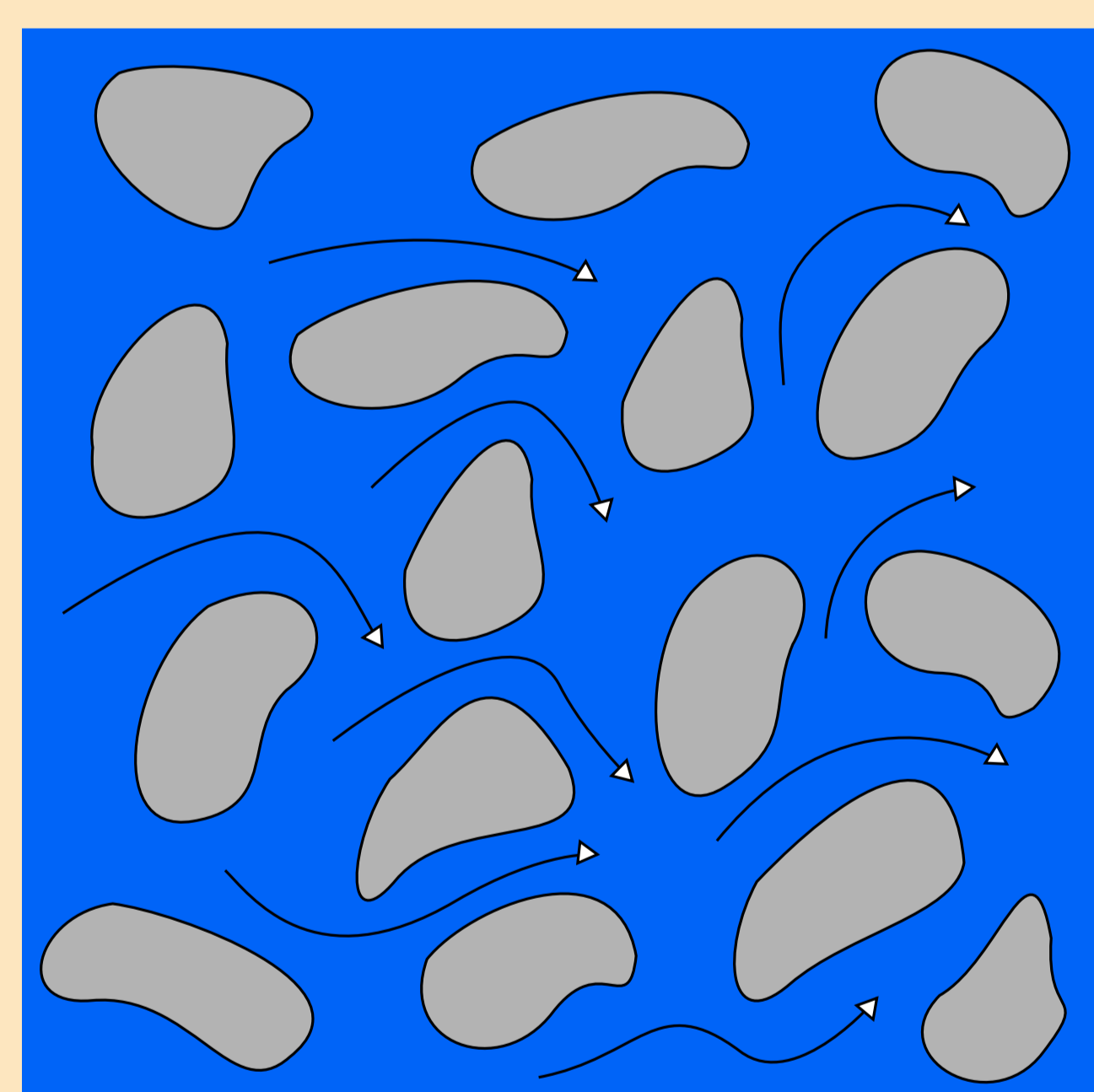
- Pseudo-spectral discretization of Navier-Stokes and species equations
- Heat transfer and particle removal efficiency, cleansing of exhaust gases
- Controlled particle migration with temperature gradient
- Focus on high volume fraction; interaction via 4-way coupling

## Filtration



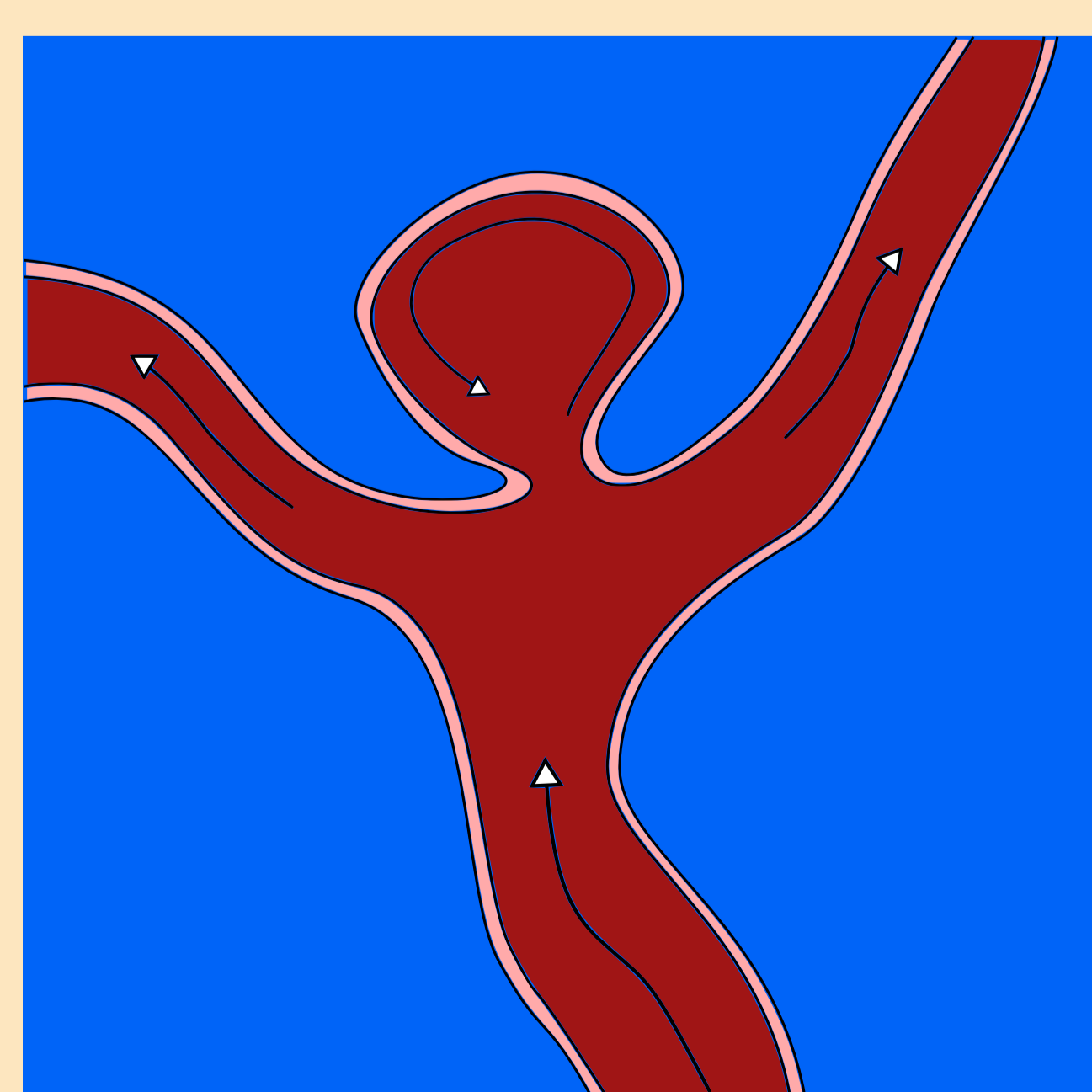
- Lagrangian particle tracking in porous media; deposition prediction
- Understanding of aerosol dynamics for medical respirators and reduction of exposure risk
- Detailed simulation of multiscale chemical and physical transport processes
- Include evaporation, condensation and reaction kinetics (VOCs)

## Porous Transport



- Immersed boundary method, skew-symmetric finite-volume discretization
- Process engineering: packed bed filters, fluidized bed reactors
- Laminar flow in complex geometries with unified transport descriptions for temperature and species
- Link microscopic and macroscopic transport phenomena via CFD

## Cerebral Aneurysm



- Immersed boundary method coupled to flow-structure interaction
- Blood circulation in cerebral aneurysms: local and regional stress analysis
- Temporal and spatial multiscale problem: rapid pulsatile flow versus long-time risk of rupture
- Patient specific computational modeling for bed-side surgical support