

Numerical Methods for High Fidelity Simulations of Gas-Liquid Multiphase Flows

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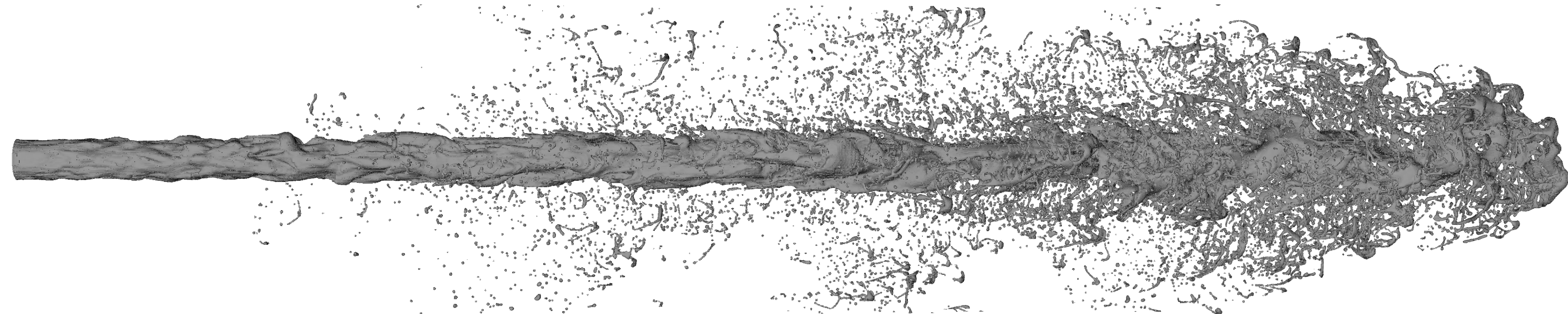
Montana State University

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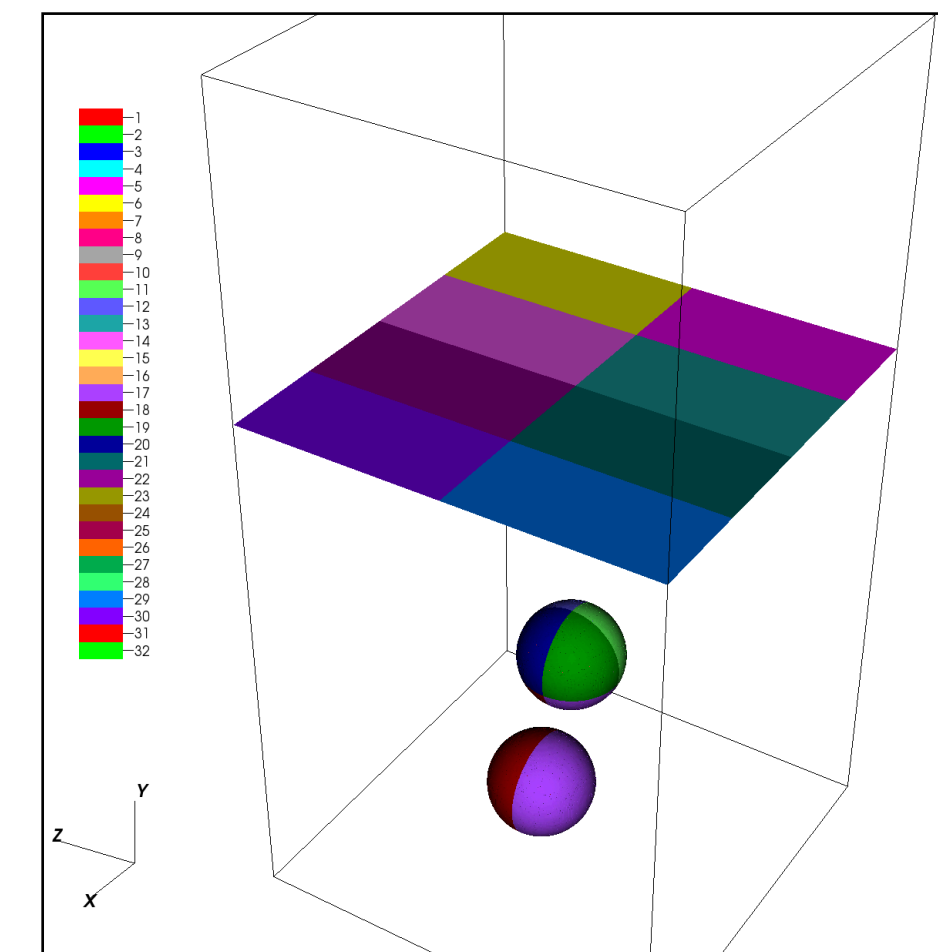
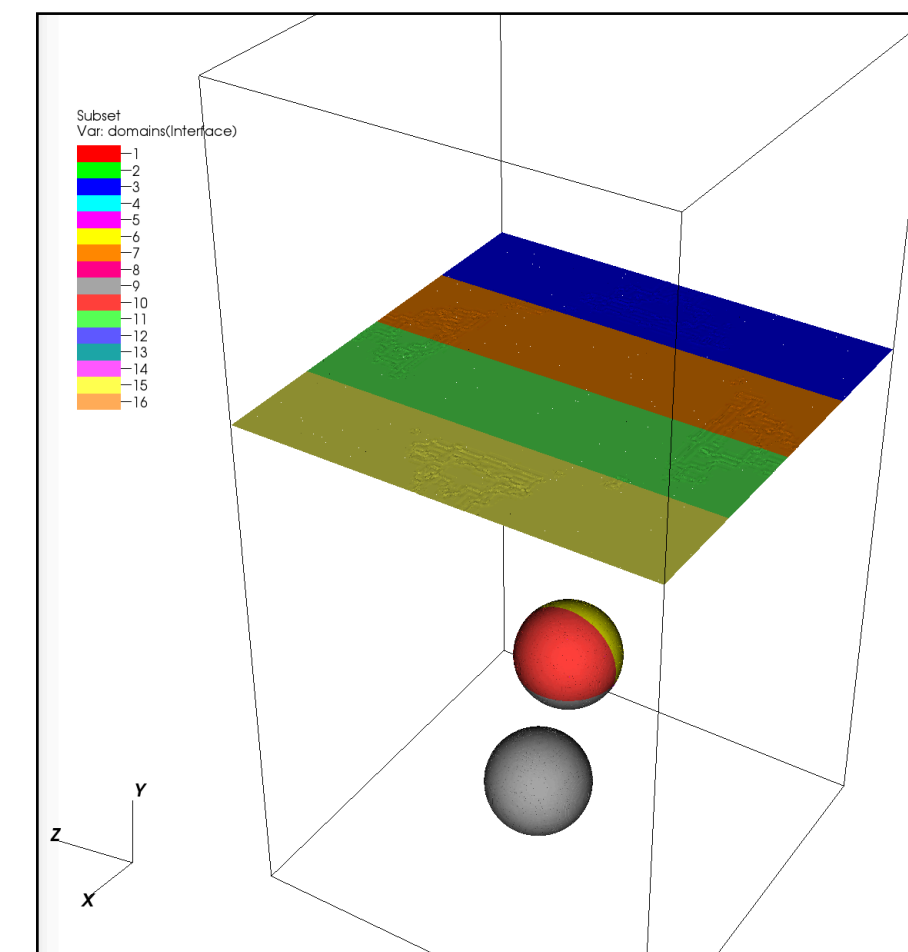
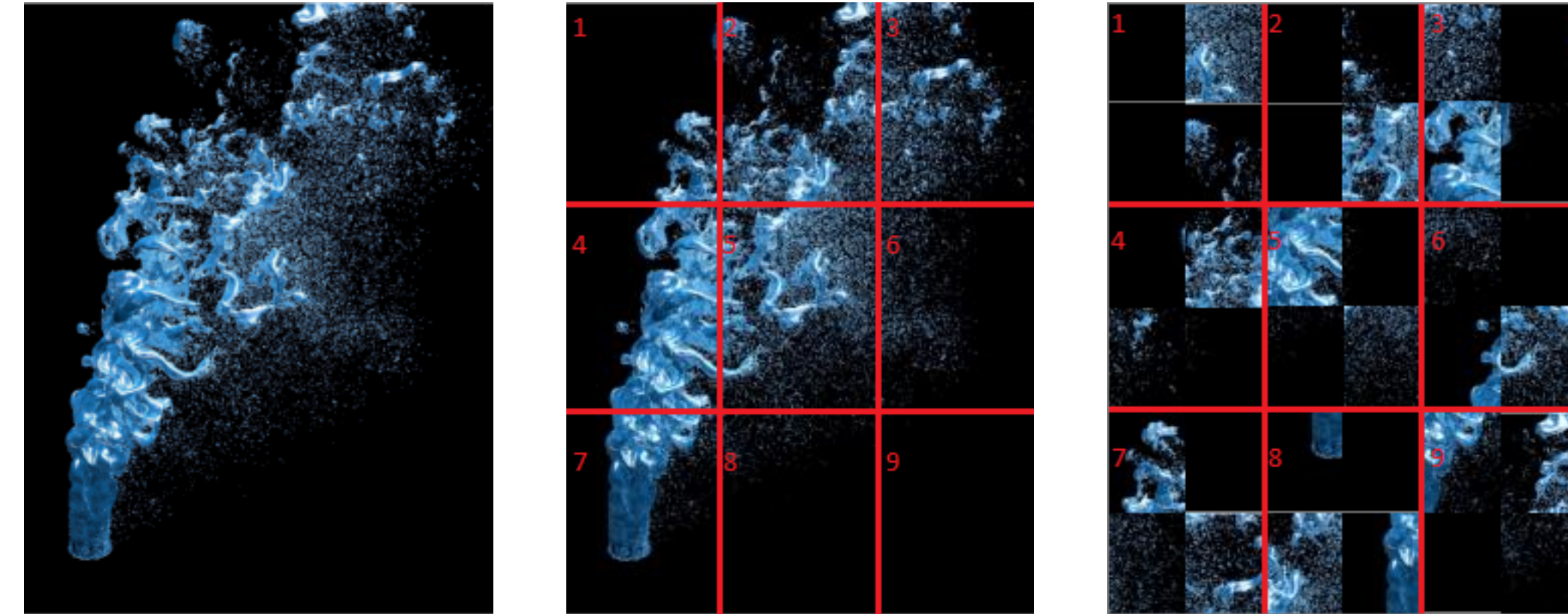
What Are Multiphase Flows?

- Widely seen throughout nature as well as industry
- Particularly focused on atomization processes and accurately capturing the complex physics therein



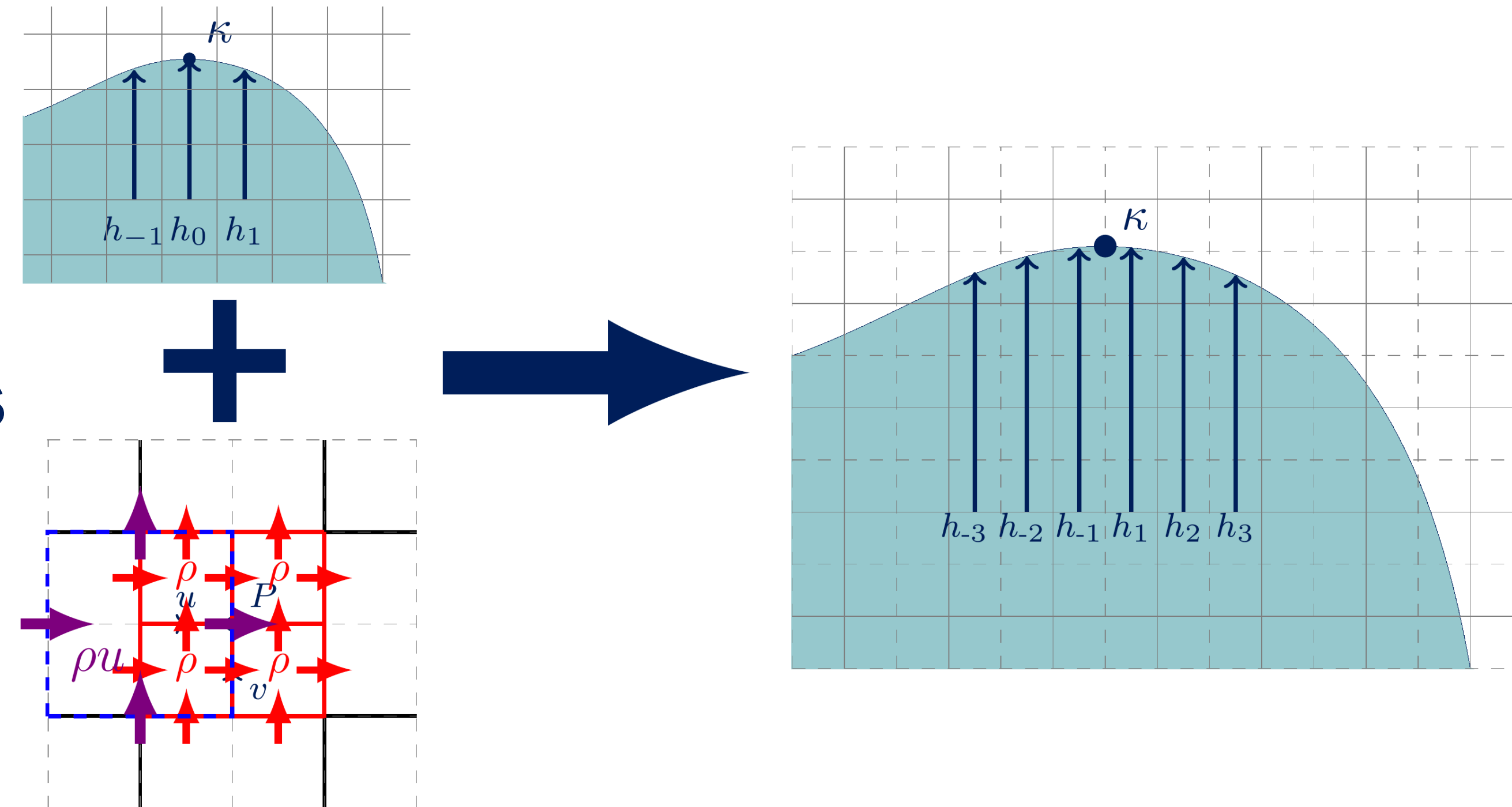
Load Balancing Strategies for Multiphase Flows

- Develop and equal workload balance across multiple processors
- Oversubscription through MPI routines results in more even workload balance across an equal amount of physical processors



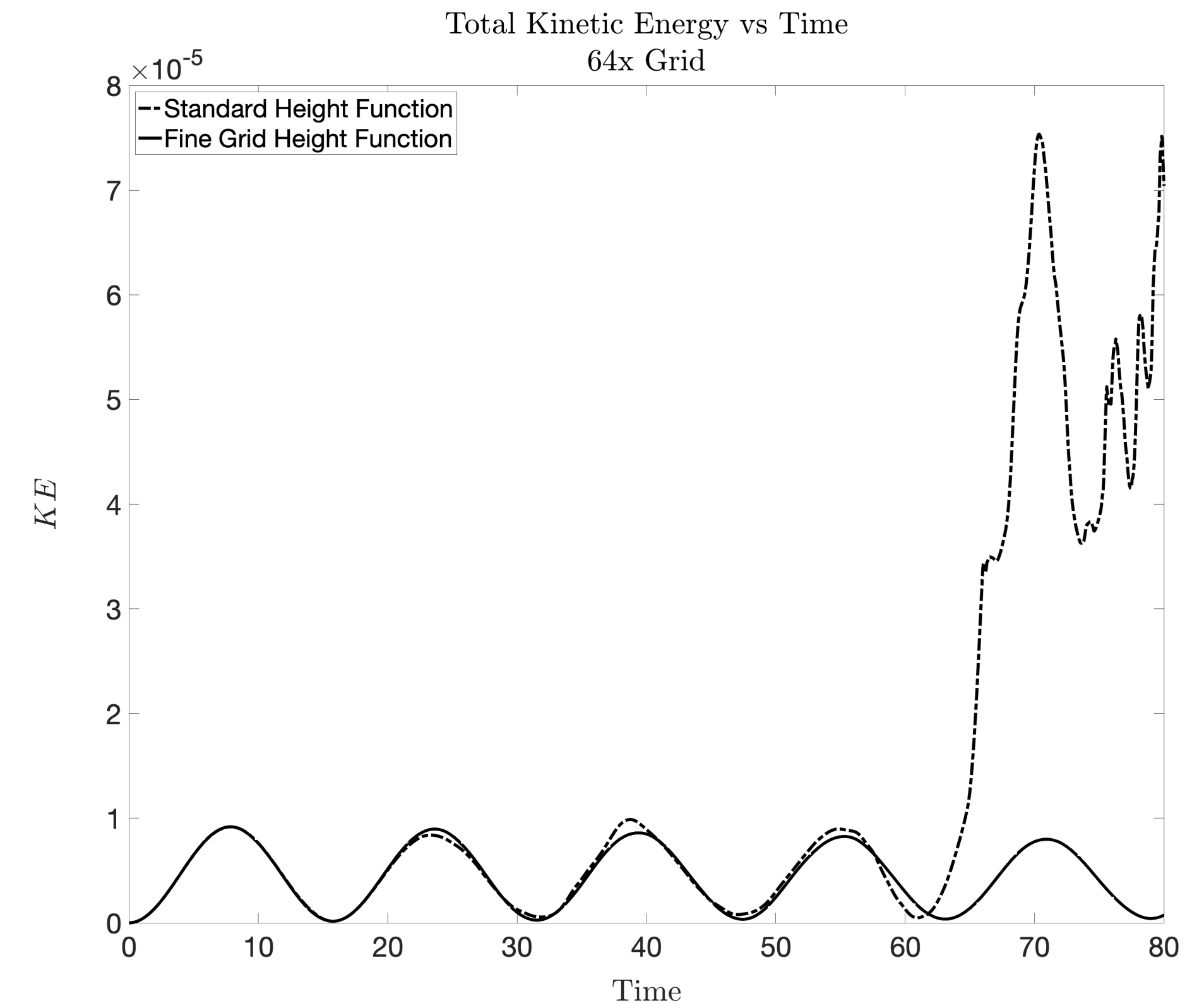
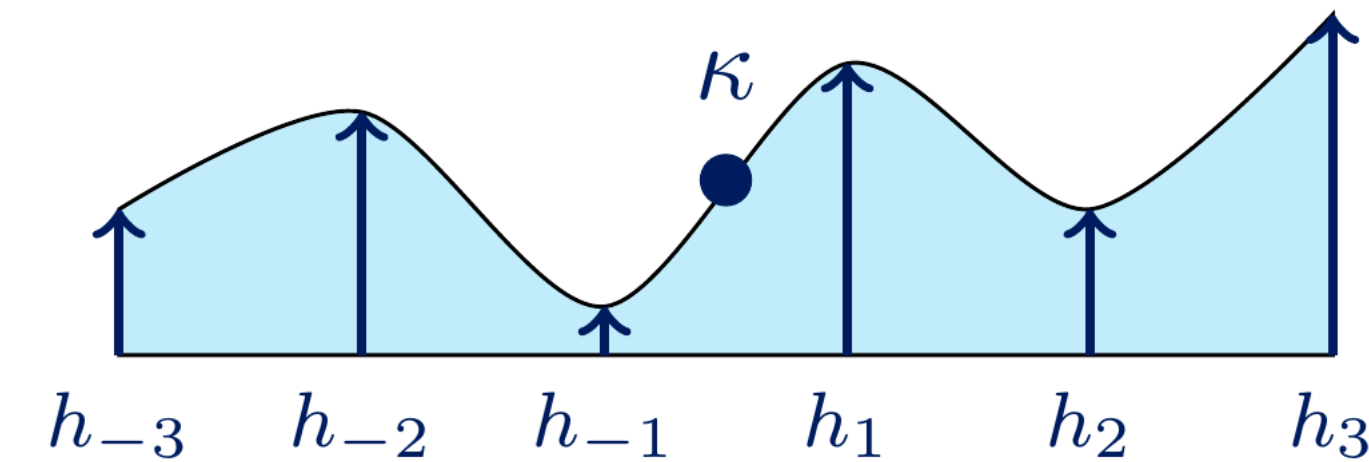
Fine Grid Height Function Method

- HFM's are a popular way to compute interface curvatures
- By incorporating on a twice as fine mesh, can achieve a 5th order accurate curvature estimation while maintaining conservative properties.



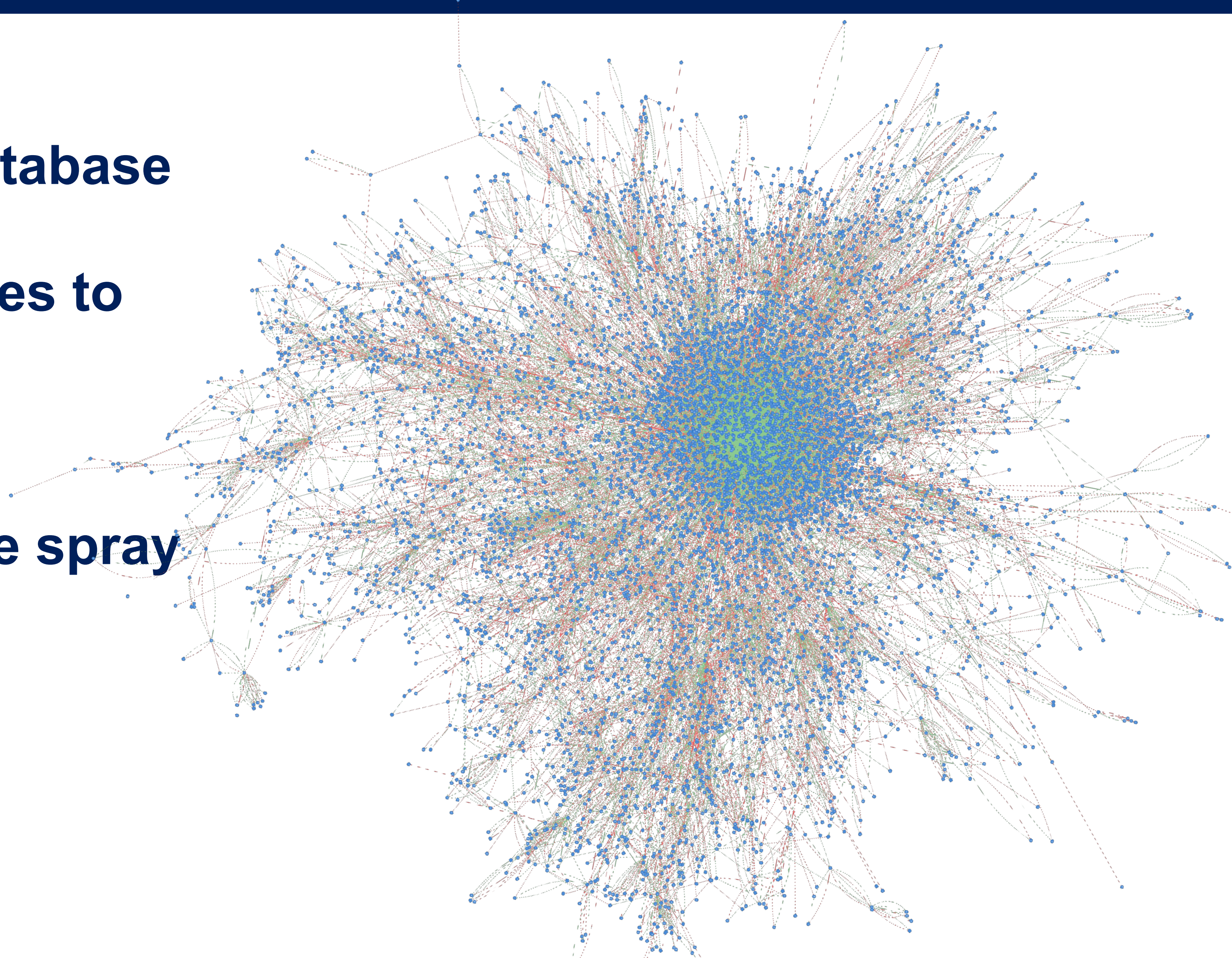
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Genealogy Extraction Techniques

- **Neo4j - graphical database used by large social networking companies to track relations**
- **Can we apply this methodology to large spray sims?**



Genealogy Extraction Techniques

- 26.6 μm : average structure diameter of primary atomization (structures that detached from core)
- 29,798 split events of primary atomization
- 17.1 μm : average structure diameter of secondary atomization (structures that detached from other structures)
- 77,362 split events of secondary atomization
- 8 TB of data reduced to 400 MB



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