Domain Specific Language for Particle Mesh Simulations

**Objectives**
- Design a Domain Specific Language (DSL) for particle mesh simulations based on a previously elaborated formal model
- Develop an optimized compiler using the new high-level DSL
- Exploit distributed HPC systems by increasing both the programmer productivity and the simulations’ performance

**Context and Background**

**Particle Methods**
- One of many simulation frameworks

**Domain Specific Languages (DSLs)**
- Address the knowledge gap
- Examples of DSLs in scientific computing: Blitz++, FreeFem++, Liszt, etc
- Ensure usability, extensibility, scalability, maintainability and flexibility

**Parallel Particle Mesh Environment (PPME)** [1]
- Abstract details of the PPM library and its debugging difficulties
- Based on a metamodel including domain-specific concepts

**Open Framework for Particles and Mesh Simulations (OpenFPM)** [2]
- A portable template-based C++ library
- Dedicated for particle-mesh simulations on HPC systems
- Offers facilities like domain decomposition, load balancing, etc

**Problem Definition**

**Upcoming Challenges**
- Model-to-model transformation for code generation
- Develop new optimizations

---

**Characteristics of OpenPME**

**OpenPME phases**
- **Initialization**
- **Simulation**
- **Visualization**

**Use case example: discrete simulation**

**References**