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Simulation of GMR in granular C@Co nanoparticles in agarose

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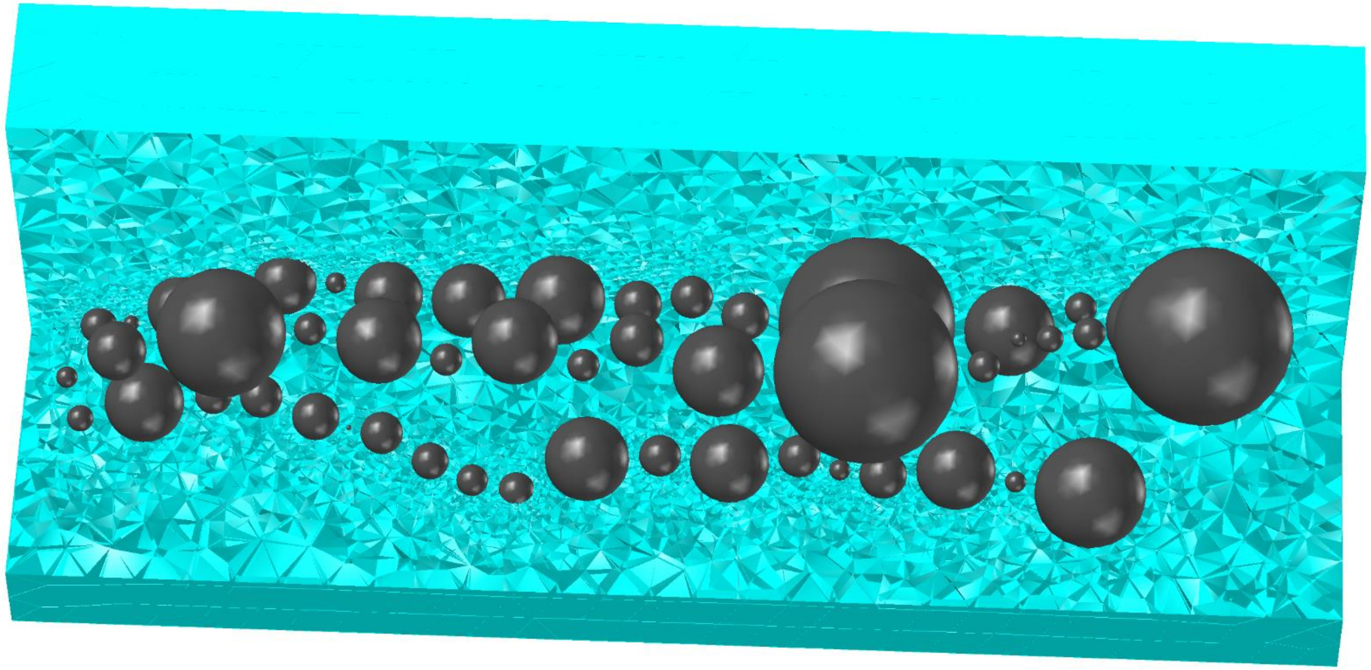

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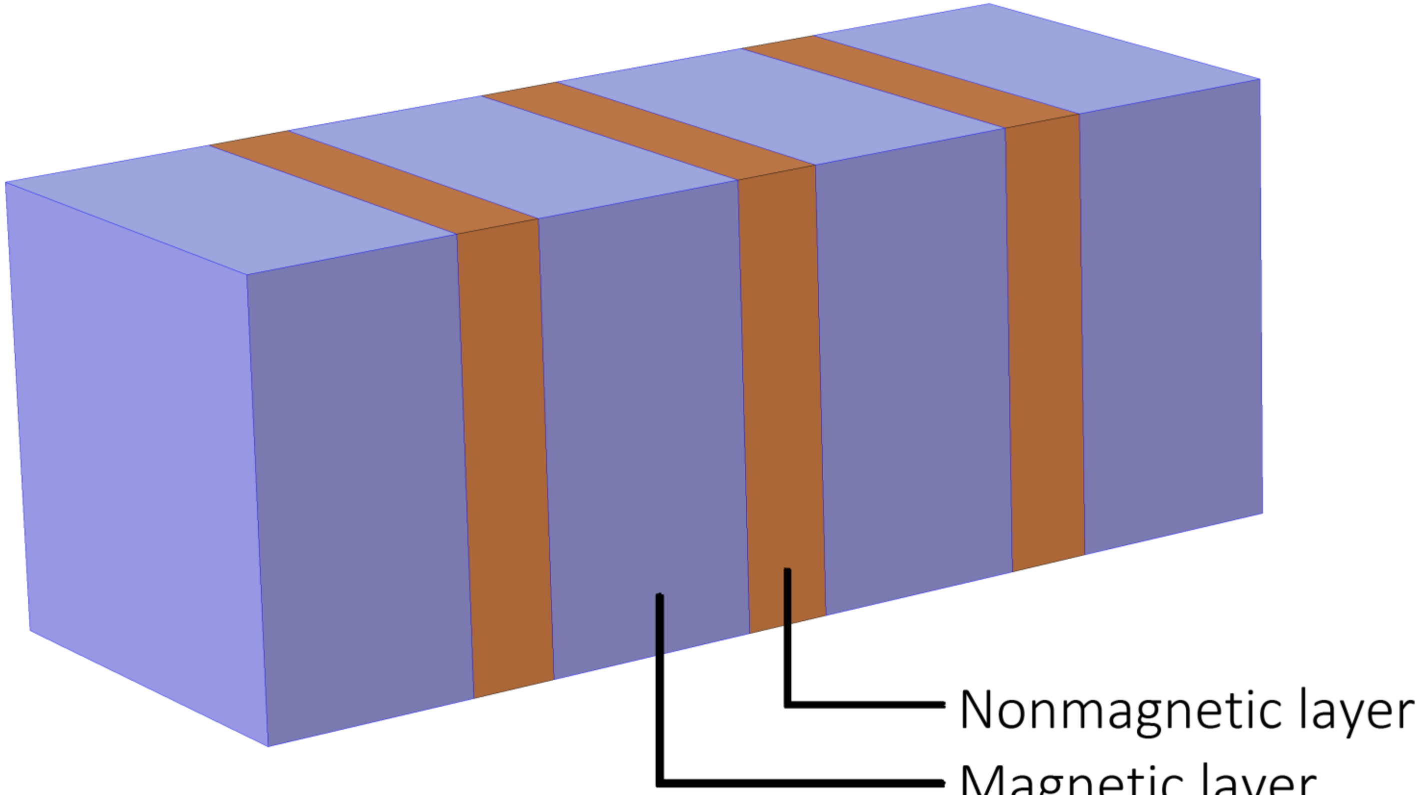
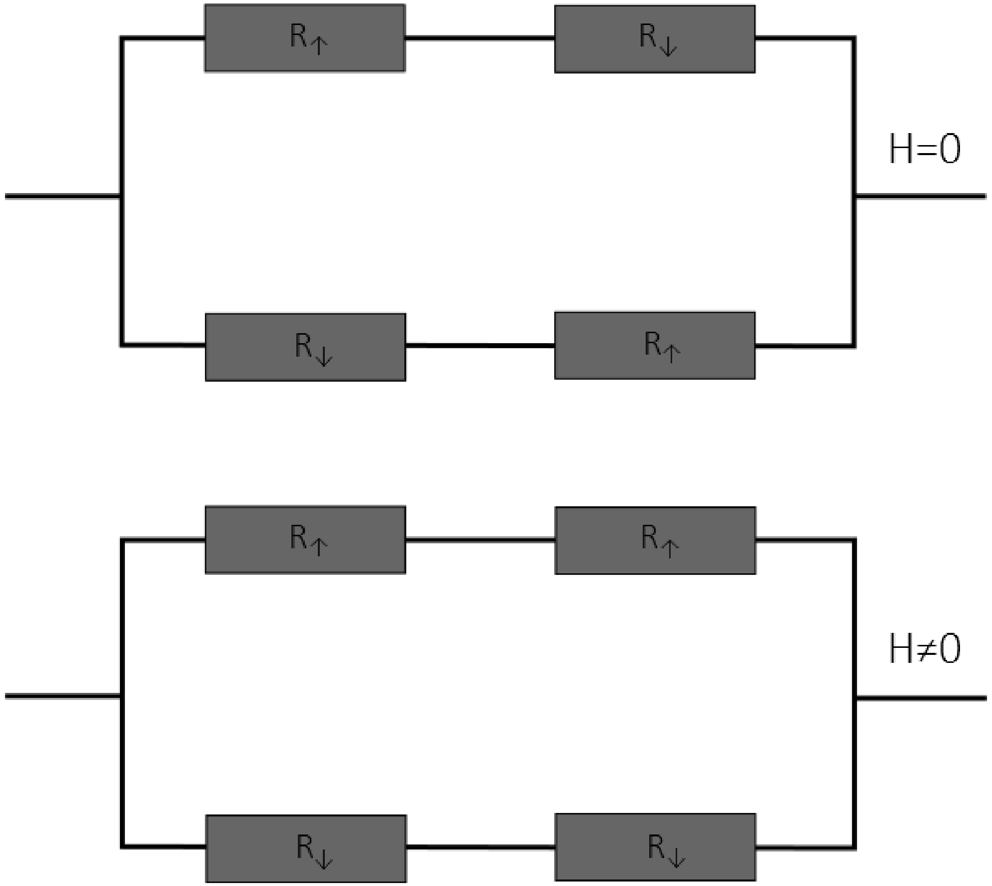
The Giant Magnetoresistance (GMR) effect

- Electrical resistance dependents on switching on and off an outer magnetic field
- Spin dependent



Spin channel currents



R↑= High resistance   R↓= Low resitance

- Spin channel currents act like in a parallel circuit
- Therefore they can be described by variegating the conductivity of the particles

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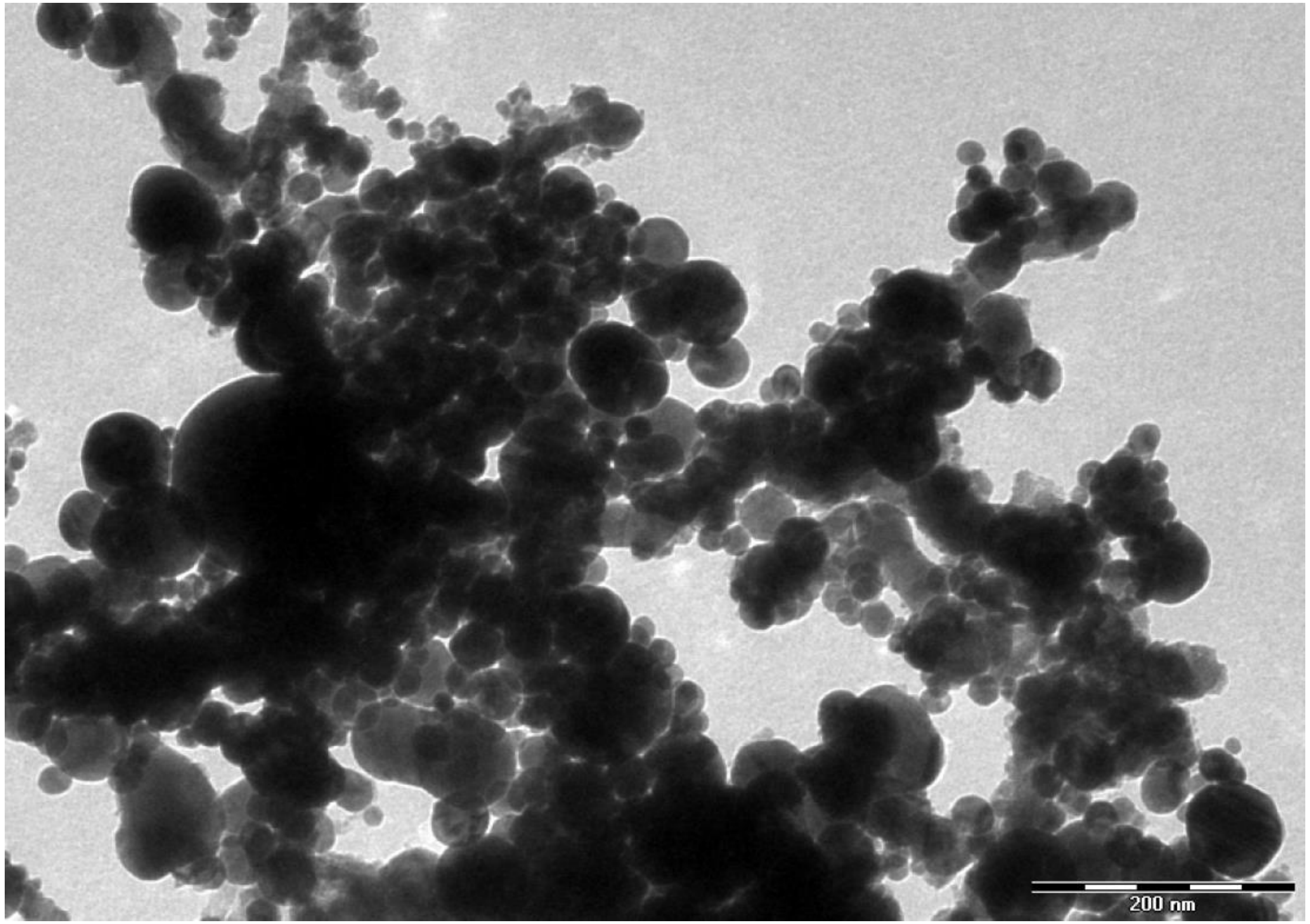
GMR in granular gels

- Many different sizes of the magnetic particles
- No high ordered structure

But:

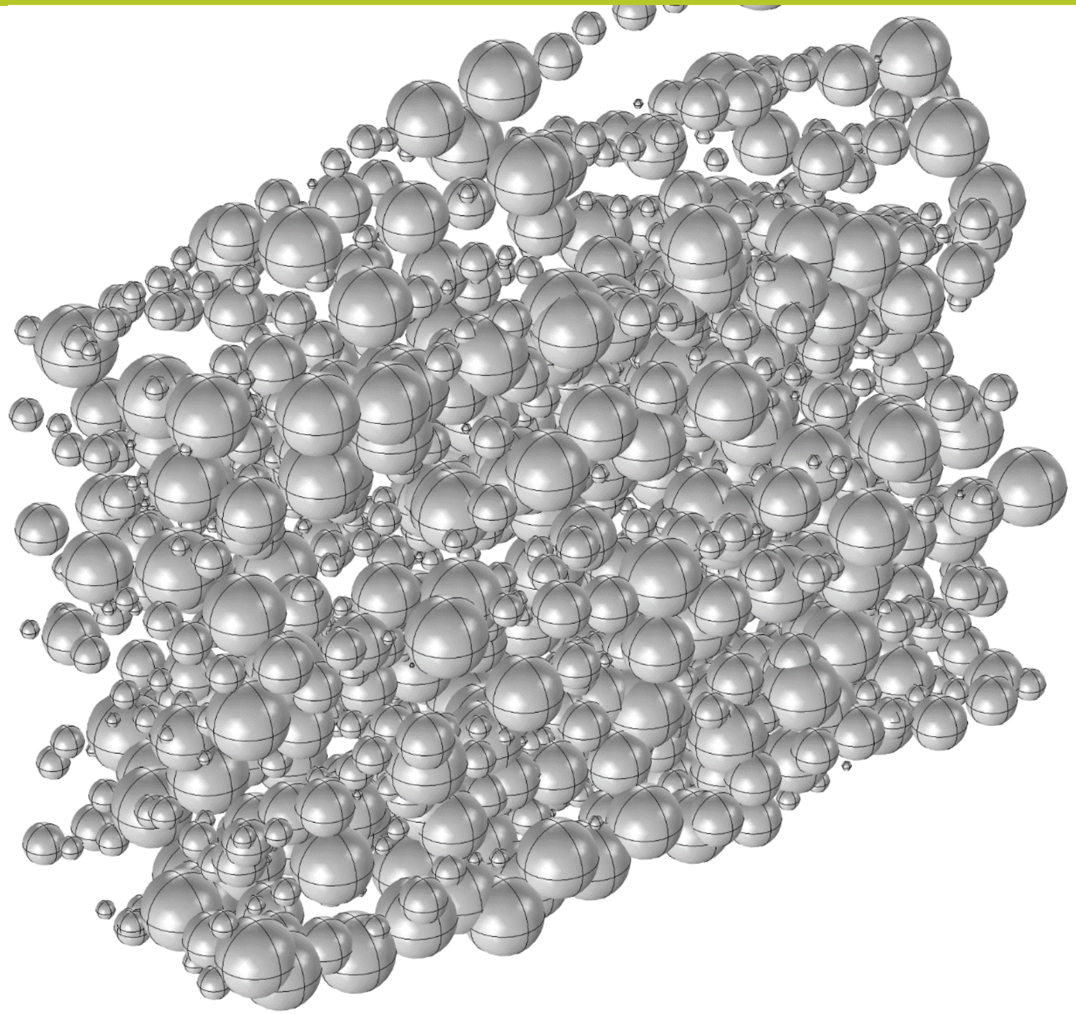
- Particle chains in antiferromagnetic order to the next neighbour



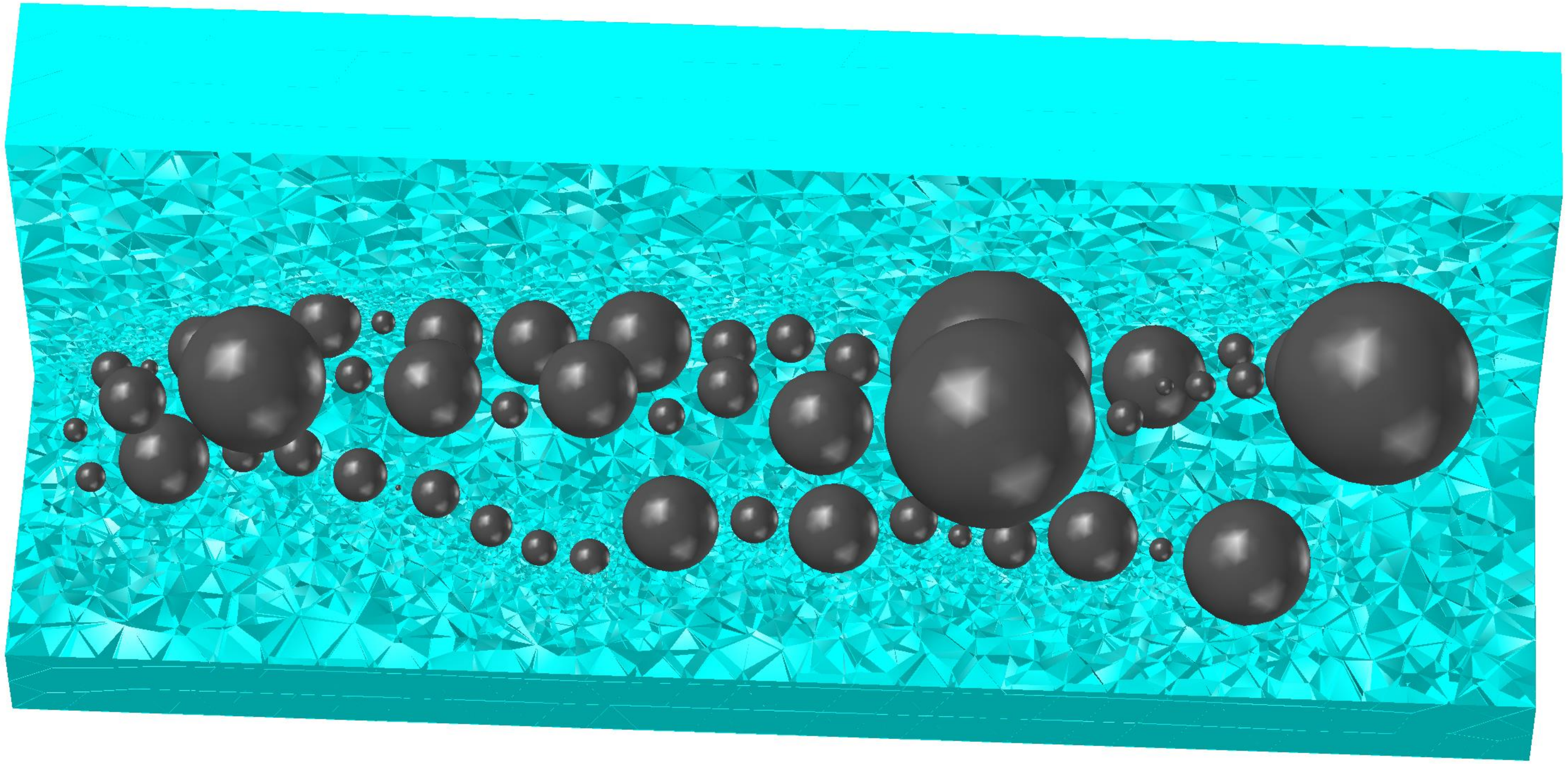
Use of the Java API

Why Java?

- Automation of generating many particles
- Fast and flexible variation of space and size distribution



Flexible geometry



Particles are variable in **space** and **size** distribution

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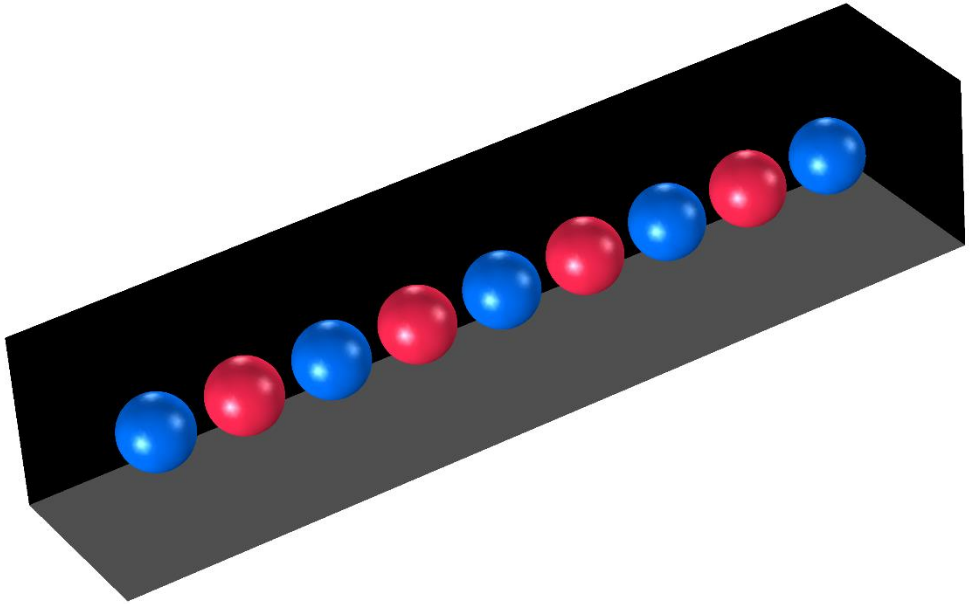
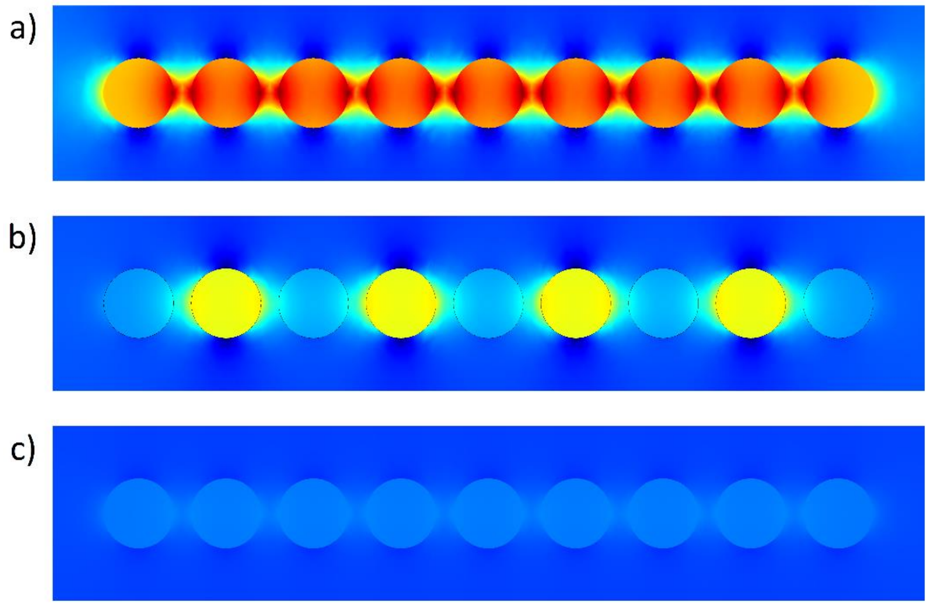
Magnetic field via electric conductivity



Parametric sweep for the 3 conductivities depending on the magnetic field



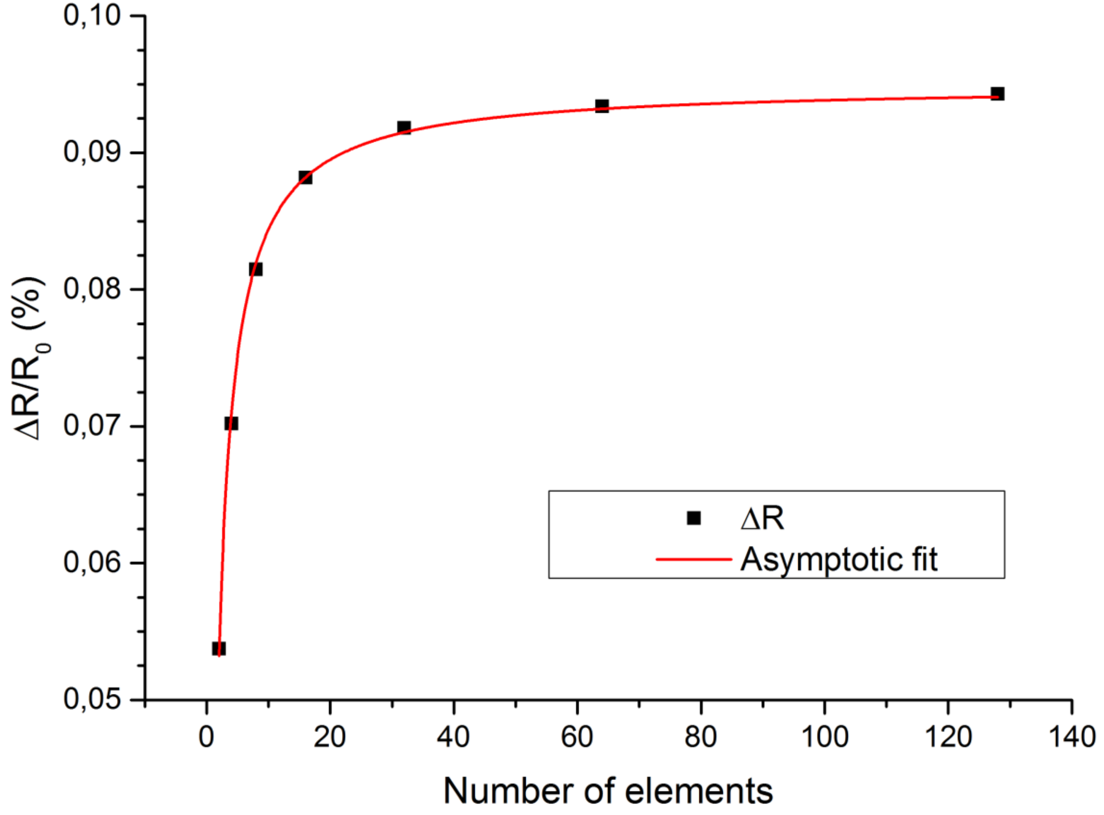
a) High and b) low conductivity in a magnetic field in contrast to c) the alternating conductivity without field

Results for a single chain

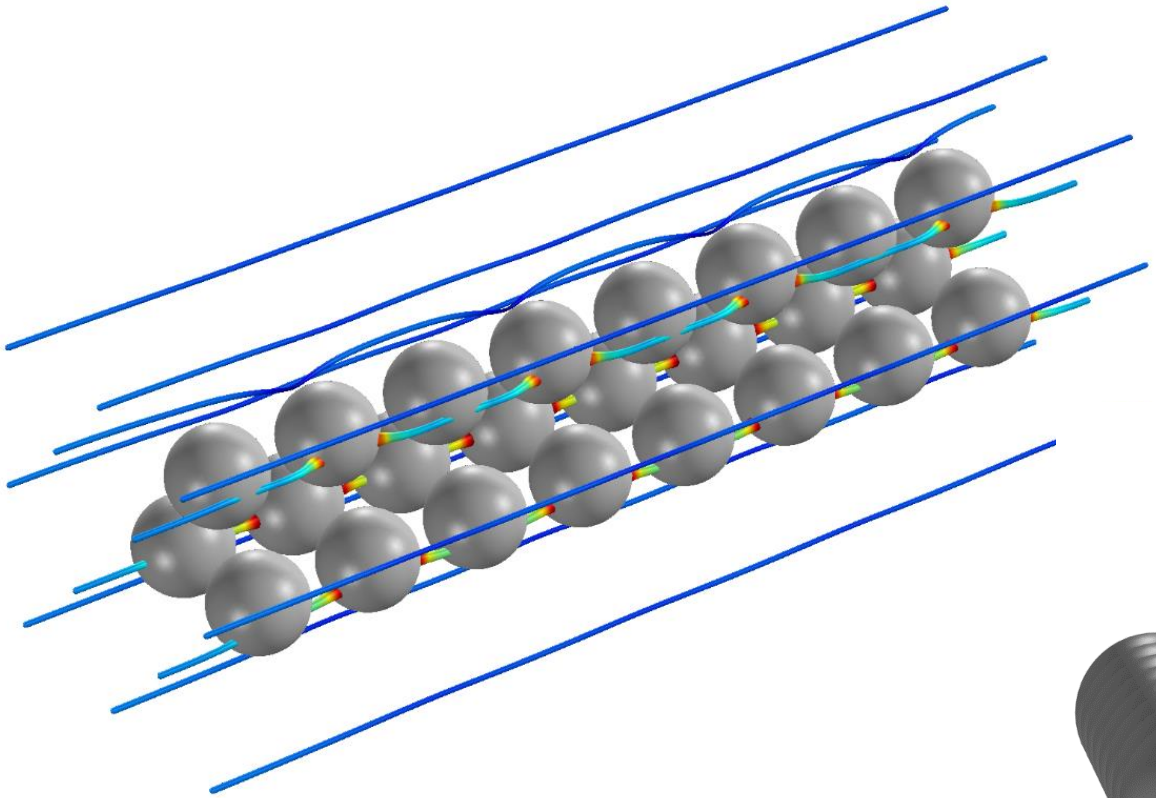
Can short chains show the effects of the in fact much longer chains?

Yes!
Because the GMR in converges very fast

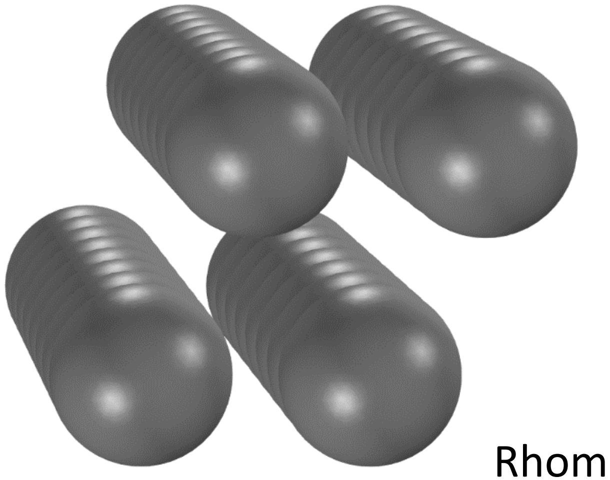
So no need of simulation of many elements



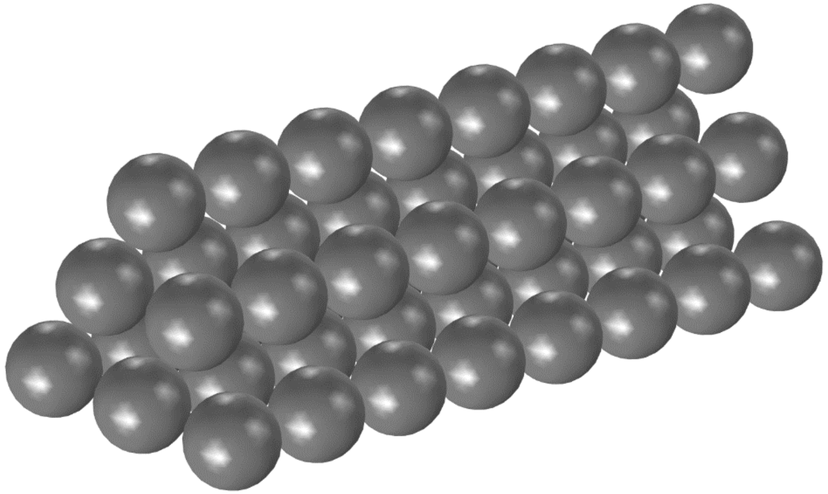
Other geometries



Triangle 3 chains

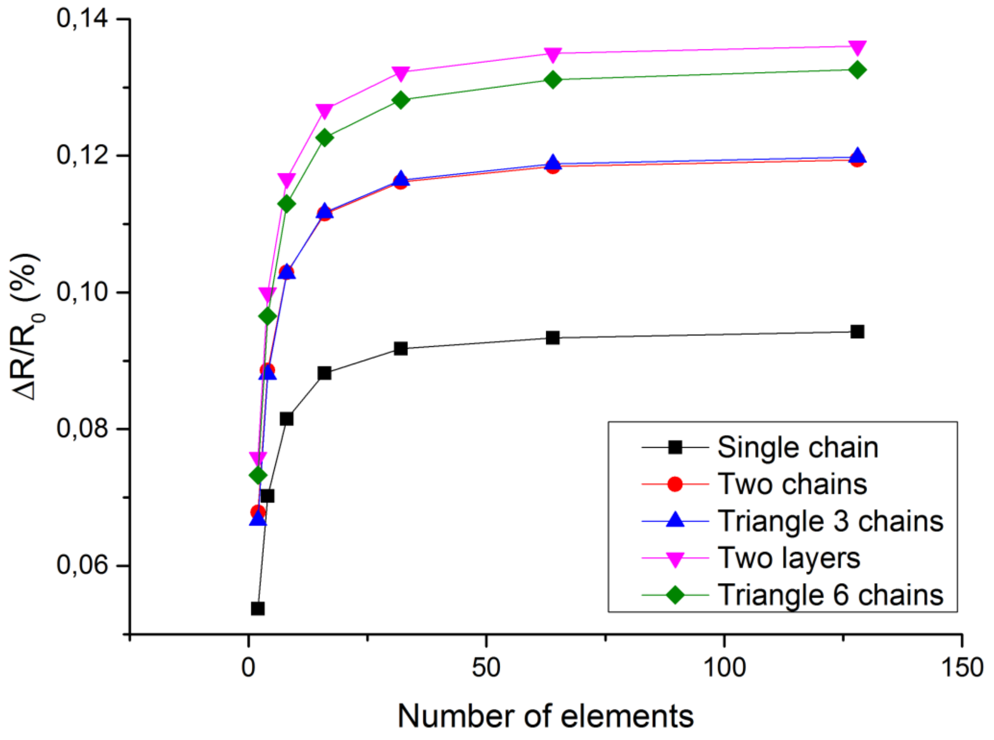


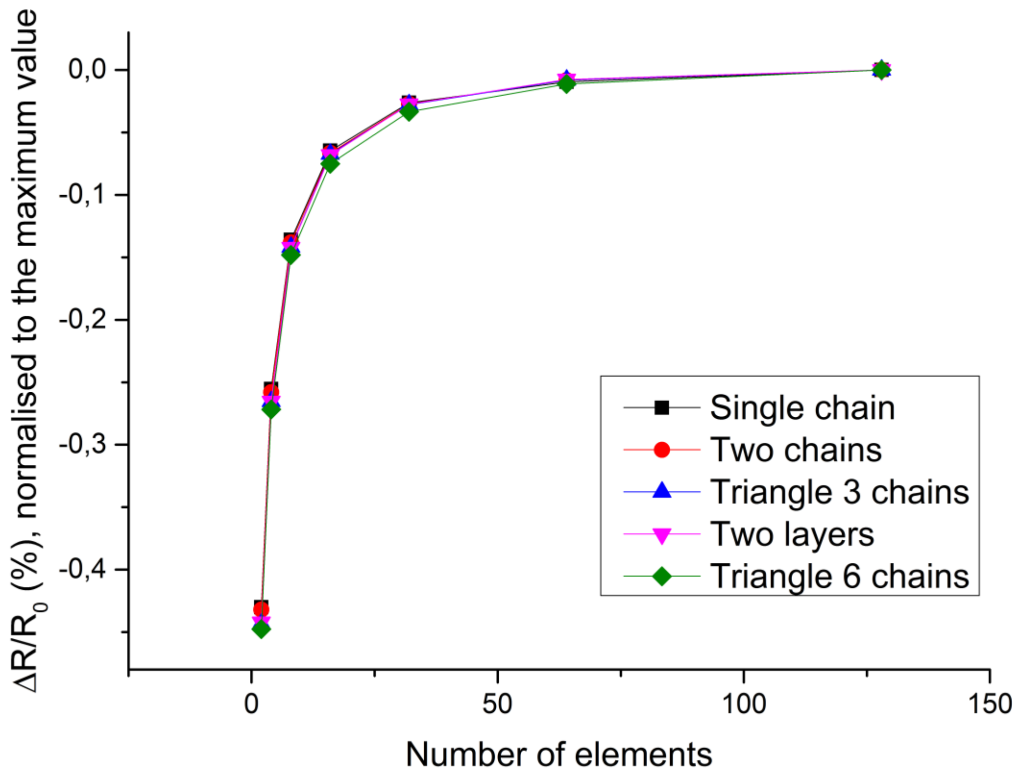
Rhombus 4 chains



Triangle 6 chains

Comparison





All geometries show similar curves

Conclusion

- Flexible and fast generation of many elements, variable in size and space distribution
- For simulation just short chains needed, because ΔR converges fast
- All geometries show similar curves

➢ Simulation of variations in particle size and disordered space distribution

Thank you for your interest!