Solid-state nuclear magnetic resonance: from physics to materials
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Nuclear Magnetic Resonance is a powerful technique that interacts with many fields, for instance physics, chemistry, cryogenics, electronics, mathematics, informatics, and of course chemistry and biology. In liquid state, NMR is sometimes used as a black box, just to check if a synthesis works. However, in solid state NMR is difficult to use if this way. Indeed, physical interactions are not averaged anymore, leading to signal broadening. Some tools can be used to remove the signals and/or to manipulate interactions either in the laboratory frame or in the rotating frame. Solid state NMR can be used on a wide range of nucleus to quantify species, study their mobility, check procedures between different parts of the sample, either by dipolar coupling or by chemical bonding. One sometimes need to avoid physical artifacts such as dead time in order to get a correct spectrum. In this case, linear prediction and other mathematical tools can be very useful. Finally, one has also to keep in mind that the sample itself can induce difficulties, especially when studying nanoparticles where the side effects become not negligible at all.

Physics
Nuclear spin
- Magic angle spinning (MAS)
- EPR
- Trapping

Mechanics
- Floor reinforcement
- Probes

Cryogenics
- Liquid helium
- Liquid nitrogen
- Liquid oxygen
- Cryostat

Mathematics
- Fourier transforms
- Calibration

Electronics
- Power amplifiers
- Tuners
- Field controllers

Informatics
- Database management
- Processing software
- Pulse programming

Chemistry
- Nuclear spin
- CSA
- Nuclear Overhauser effect (NOE)

Biology
- Thalassiosira Pseudonana
- Thalassiosira Pacifica
- Thalassiosira Pacifica 15 kVA, 1h

Conclusions
- NMR is precise but not sensitive
- NMR is a powerful technique that interacts with many fields
- NMR is sometimes used as a black box, just to check if a synthesis works.
- In solid state NMR is difficult to use if this way. Indeed, physical interactions are not averaged anymore, leading to signal broadening.
- Some tools can be used to remove the signals and/or to manipulate interactions.