# Taming the influence of dipolar interactions in nanoparticle assemblies for magnetic hyperthermia

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Magnetic hyperthermia is one of the most promising biomedical applications of magnetic nanoparticles (NP) and is intended to be alternative to cancer therapies based on drug delivery and radiotherapy. The range of suitable intrinsic parameters of the NP (such as saturation magnetization, anisotropy, shape and size) [1] and of applied magnetic ac fields that maximize the specific absorption rate (SAR) has been thoroughly studied [2] and mostly understood. However, there is still ongoing controversy on the role that aggregation state of the assemblies and dipolar interactions (DI) play on SAR. Here, we will study in regular lattices on SAR using Monte Carlo simulations of hysteresis loops in the macrospin approximation [3], showing that SAR can be increased or decreased with respect to the non-interacting case depending on the spatial arrangement of the NP assembly, particle size and separation. Next, we will show that, although in random assemblies dipolar interactions usually decrease SAR, their pernicious effect can be diminished by controlling: 1) the thickness of the surfactant covering the NP forming the clusters (Fig. a), 2) the regions on which the NP are deposited [4] (inside and at the surface of liposomes/cells, clusters), and 3) the global shape of the disordered assemblies (Fig. b). Acknowledgments: Work supported by Spanish MINECO (PGC2018-097789-B-I00, PID2019-109514RJ-I00), Catalan DURSI (2017SGR0598) and EU FEDER funds (Una manera de hacer Europa) also CSUC for supercomputer facilities.

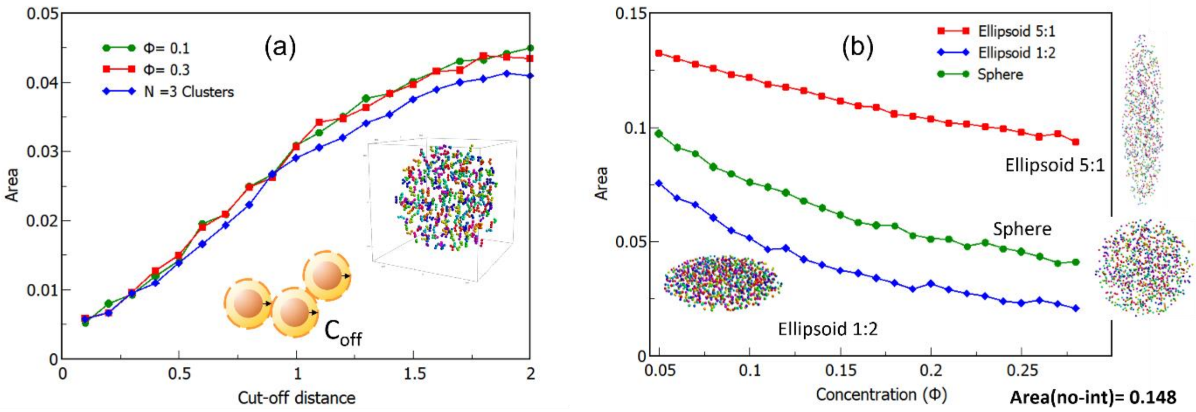


Figure 1: Surfactant thickness (a) and concentration (b) dependence of the hysteresis loop area (SAR) for different kinds of NP random assemblies.

## References

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