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The beauty of contrast variation in SANS for soft matter : playing beyond classical studies in 4-components systems

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We all learn in textbooks that contrast variation is a unique possibility that makes SANS so powerful to probe the “extraordinary structure of ordinary things” in soft matter. But there is a clear difference between reading it and experiencing it by itself. As for my part, I discovered it the very first time I came in Grenoble during my pHD when I tried to probe the structural organization of a few spherical magnetic particles dispersed in a sea of clay nanoparticles that I contrast-matched [1]. It was an unforgettable souvenir and this is in great part because I had the chance to have a young, very efficient and very friendly local contact that arrived just some monthes ago before at ILL: Isabelle! We did not know at that time that we’ll become good friends later and that we’ll meet so often, when either she was coming in Saclay, when I was coming in Grenoble and during schools we organized together.

Thus, later during my academic career, I tried to push the contrast variation method up to its limit by considering four-components systems. I will show that playing with contrast in such systems remains possible if the system is craftily designed with respect to neutrons, with three of the components having a close SLD, very different from those of the component to be characterized, or if two pairs of components have the same contrast. I will illustrate it by examples taken from representative systems of soft matter : nanocomposites made of polymeric melts reinforced by nanoparticles [2],colloidal suspensions of complexes polyelectrolyte and proteins of opposite charges [3,4], and foams [5].

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