Solid-state NMR studies of membrane proteins in native environments at 100 kHz MAS

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Over the last decades, magic-angle spinning (MAS) NMR has become a powerful method for structure and dynamics investigations of biological systems of increasing complexity. Technical and methodological advances in the field have enabled the development of faster spinning probes, which allowed the structural characterization of fully protonated proteins, via proton-detected approaches.

Here we demonstrate the advantages of proton-detected solid-state NMR at 100 kHz MAS and high fields to study fully protonated membrane proteins reconstituted in lipid membranes. The high MAS rates allow unprecedented proton resolution, and gives access to rapid and extensive resonance assignment of backbone and side chain protons of both transmembrane and solvent-exposed portions of a protein, without the need of proton dilution. This in turn allows the identification of contacts between crucial hydrophobic protein regions spanning the lipid bilayers, which are essential for protein assembly and function. More in general, we show how this technique establishes a general approach for high-resolution studies of complex non-crystalline systems.