

Manifestation of Berry's Phase in Nuclear Quadrupole Resonance Spectra of Rotating Powder Samples

Nikolay Sinyavsky^a, Mariusz Maćkowiak^b, and Claudia Schmidt^c

^a Baltic State Academy, Molodiozhnaya str. 6, 236029 Kaliningrad, Russia

^b Institute of Molecular Physics, Polish Academy of Sciences, Smoluchowskiego 17, 60-179 Poznań, Poland

^c Department Chemie, Universität Paderborn, Warburger Str. 100, D-33098 Paderborn, Germany

Reprint requests to Prof. N. S.; E-mail: sinyavsky_physics@bga.gazinter.net

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The effect of Berry's phase on the nuclear quadrupole resonance (NQR) spectra of rotating powder samples is studied experimentally, and its application for the determination of the electric field gradient asymmetry η is demonstrated. The NQR frequency splittings, which are observed for the spin 3/2 nucleus of ^{35}Cl in powder samples of *p*-dichlorobenzene ($\text{C}_6\text{H}_4\text{Cl}_2$) and cyanuric chloride ($\text{C}_3\text{N}_3\text{Cl}_3$), are interpreted as a manifestation of Berry's phase, associated with the adiabatically changing Hamiltonian due to sample rotation. The accumulation of Berry's phase during the rotation process is responsible for the observed dependence of the NQR line shape on the rotation frequency and the asymmetry parameter. The proposed method for the determination of η involves the analysis of the NQR powder patterns of the rotating samples.

Key words: Berry's Phase; Nuclear Quadrupole Resonance; Electric Field Gradient Tensor; Asymmetry Parameter.