Quadrupole Moments of the $^{40}\text{Ca}$ Core Plus One Nucleon Nuclei $^{41}\text{Sc}$ and $^{41}\text{Ca}$


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The electric-field-gradient (EFG) and anisotropic chemical shift of $^{45}\text{Sc}(I^* = 7/2^-, \text{stable})$ in TiO$_2$ crystal were determined by detecting the FT-NMR of $^{45}\text{Sc}(0.5 \text{ atm}\% \text{ of Ti in TiO}_2)$ doped in TiO$_2$ crystal at a high field of 7.0 T and 9.4 T. Using the EFG, an old $\beta$-NQR spectrum of $^{41}\text{Sc}$ was reanalyzed to obtain $eQ^{(41}\text{Sc})/\hbar$ which was combined with the renewed $Q^{(45}\text{Sc}) = -(23.6 \pm 0.2) \text{ fm}^2$ to obtain $|Q^{(41}\text{Sc}; I^* = 7/2^-, T_{1/2} = 0.596 \text{ s})| = (15.6 \pm 0.3) \text{ fm}^2$. Also the atomic EFG in Ca was recalculated, using a finite-element multi configuration Hartree-Fock method to renew $Q^{(43}\text{Ca})$. Finally using the known hyperfine constants of $^{41}\text{Ca}$, the $Q^{(41}\text{Ca})$ value has been renewed.

Keywords: Quadrupole Moments of Sc and Ca Isotopes; Electric Field Gradients; Ca and Sc Atoms; TiO$_2$. 