(11.8) The observed quadrupole moment of ^{59}Co is 0.40 barn. (a) What is the deformation value β? (b) What spin value is expected from the Nilsson diagram?

(a) $Q_{obs}=Q*(I\text{-}1/2)/(I+1)$, $Q=2*Z*(a^2\text{-}c^2)/5$ and $\beta=2*(a\text{-}c)/(a+c)$: Dimension of Q_{obs} is m^2.

$$Q_{obs} := 0.40 \cdot 10^{-28} \cdot m^2 \qquad Q_{obs} = 4 \cdot 10^{-29} \cdot m^2 \qquad I := \frac{7}{2} \qquad Q := Q_{obs} \cdot \frac{I+1}{I-\frac{1}{2}} \qquad Z := 27$$

We will use the identity: $(a\text{-}c)/(a+c)=(a^2\text{-}c^2)/(a+c)^2$, and then approximate $(a+c)$ by $2*r_{average}$.

$$Q = 6 \cdot 10^{-29} \cdot m^2 \qquad a2mc2 := \frac{5}{2} \cdot \frac{Q}{Z} \qquad a2mc2 = 5.556 \cdot 10^{-30} \cdot m^2 \qquad A := 59$$

$$r_0 := 1.3 \cdot 10^{-15} \cdot m \qquad apc := 2 \cdot r_0 \cdot A^{\frac{1}{3}} \qquad \beta := 2 \cdot \frac{a2mc2}{apc^2} \qquad \beta = 0.108$$

(b) We have an odd proton as number 27. Then Fig. 11.8 indicates spin 7/2.