

Zeitschrift: Helvetica Physica Acta
Band: 34 (1961)
Heft: [6]: Supplementum 6. Proceedings of the International Symposium on polarization phenomena of nucleons

Artikel: Polarization of protons by an A.C. sextapole magnetic field
Autor: Tanner, N.W. / Domingo, J.J.
DOI: <https://doi.org/10.5169/seals-513266>

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 10.08.2025

ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

Polarization of Protons by an A. C. Sextapole Magnetic Field

By N. W. TANNER, Clarendon Laboratory, and
J. J. DOMINGO, California Institute of Technology

The d.c. sextapole magnetic field has been proposed as a method of polarizing atomic hydrogen, the motion of the atoms being sinusoidal for one orientation of the atomic magnetic dipole and exponentially divergent for the other. If the polarized atomic hydrogen is ionized in a weak magnetic field, a nuclear polarization of 50% can be achieved.

It appears likely that nuclear polarizations of $> 50\%$ can be achieved with an a.c. sextapole field of the form

$$|H| = \alpha (1 - \cos \omega t) r^2,$$

which gives an equation of motion for a magnetic dipole

$$m \ddot{r} = - 2\mu_{eff} \alpha (1 - \cos \omega t) r.$$

The solutions of this equation are Mathieu functions [1], for $\mu_{eff} = \pm \mu_0$, and, presumably, similar functions for $\mu_{eff} = \pm \mu_0 H (H^2 + H_0^2)^{-1/2}$. For $\mu_{eff} < 0$ the solutions diverge rapidly. For $\mu_{eff} > 0$ the solution may be stable or divergent oscillations depending on the values of α and ω and it appears likely that one of the two positive values of μ_{eff} could be kept stable while the other is divergent.

Putting $\alpha = 4 \times 10^4$ gauss/cm² and $\omega/2\pi = 7.55$ kc/s, the component with $\mu_{eff} = +\mu_0$ would be diverged by a factor of $\sim e^4$ in 1 m while at least some part of the other positive component would remain stable. Alternatively, for $\alpha = 4 \times 10^4$ gauss/cm² and $\omega/2\pi = 6.16$ kc/s, the component $\mu = +\mu_0 H (H^2 + H_0^2)^{-1/2}$ might be largely diverged.

REFERENCE

- [1] N. W. McLACHLAN, *Theory and Application of Mathieu Functions*, O.U.P., (1947).