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COLLAPSE OF POLARIZED ATOMIC STATES IN MAGNETIC FIELDS

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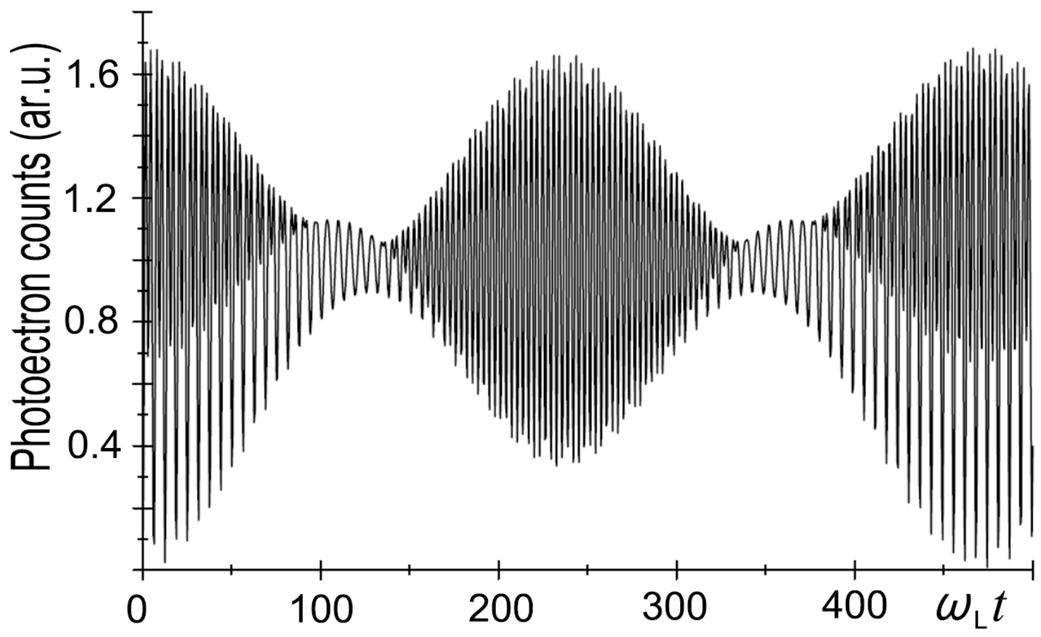
On the basis of graphical techniques, we have derived analytical expressions for the photoelectron current upon photoionization of polarized atomic states by polarized light in magnetic fields. We show as an example the observed signal when two-photon excited xenon state with J=2, M=2 (jl-coupling) is photoionized by right-circular polarized photons in an applied magnetic field which results in the Paschen–Buck effect. The presented results are of interest in spectroscopy of low temperature laboratory plasma as well for astrophysical research.

In this contribution we present a progress of our cooperative work in newly open areas of our investigation. On the basis of graphical techniques described in the book by E. El-baz and B. Castel (Graphical Methods of Spin Algebras, New York, 1972) we have derived analytical expressions for the photoelectron current I(t) upon photoionization of polarized atomic states by polarized light in magnetic fields. Figure 1 exhibits as an example the observed signal when two-photon excited xenon state with J=2, M=2 (jl-coupling) is photoionized by right-circular polarized photons in an applied magnetic field which results in the Paschen-Buck effect.



We show that the results of presented investigation are very important not only in physics such as astrophysics, plasma physics but also in spectroscopy of laboratory plasma (see e.g. Condon& Shortley 1959, Foot 2005, Dimitrijević et al. 2019).

References:

Condon, E.U., Shortley, G.H.: 1959, The theory of atomic spectra, Cambridge University Press, Cambridge.
Dimitrijević, M. S., Srećković, V. A., Zalam, A. A., Bezuglov, N. N., & Klyucharev, A. N. : 2019. Atoms, 7(1), 22.
El-Baz, E., & Castel, B.:1972 Graphical methods of spin algebras in atomic, nuclear, and particle physics New York.
Foot, C.J.: 2005, Atomic Physics, Oxford masters series .