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Photo-disintegration of N=Z light nuclei using SRC-based approach

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The outcome of any possible nucleosynthesis scenario is strongly affected by the photodisintegration of nuclei through (γ, N) and (γ, np) channels for Eγ > 10MeV to a few hundred MeV. Though there is a wide range of phenomenological models for the estimation of excitation functions in this energy region, the exact photodisintegration mechanism is not well understood. The shell-model based approaches have not been successful even for the light nuclei of astrophysical importance like 6Li [1]. By extending the Independent PAir Model [2] (IPAM), a SRC-based approach is employed to calculate the photo-disintegration of light nuclei in quasideuteron region. Combining the Gunn-Irving photo-disintegration for α-cluster [3], the proposed approach is used to calculate the total photo-disintegration cross-sections for Eγ between 10 to 140 MeV for many of the N=Z light nuclei from 4He to 40Ca. Contrary to general perception, the quasideuteron photodisintegration contribution starts in the GDR region itself [4] and dominates at Eγ > 50 MeV. Along with many interesting new insights, the derivation of the Levinger [5] formula is obtained without any additional assumption. A significant fraction of the photo-disintegration cross-section in GDR region may be accounted by contribution of quasi-α degree of freedom which decreases for higher Eγ. The present work suggests an alternative and viable description of photodisintegration for N=Z nuclei in terms of np-SRCs/quasideuteron structures and their paired counterparts.

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