Towards NUclear Reactions Essential for A Comprehensive Hindsight of the universe

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To gain insight into the universe, spanning from physics Beyond the Standard Model to the understanding of cosmic phenomena and cataclysmic events shaping our world, a unified approach to nuclear structure and reaction mechanisms—extending beyond the elastic threshold—is crucial. This necessitates the integration of few-body techniques with *ab initio* many-body calculations for the internal structure of the nucleus, all underpinned by an uncertainty quantification scheme facilitated by Effective Field Theory.
In this presentation, I will provide an overview of the No-Core Shell Model with Continuum method (NCSMC) [1], highlighting its key components and potential extensions to heavier systems. I will demonstrate how NCSMC empowers us to compute reactions involved in primordial nucleosynthesis from fundamental principles [2, 3]. This talk will offer a concise outline of the formalism, accompanied by selected applications focused on computing nuclear reactions pertinent to astrophysics e.g., [4].
The current challenge lies in devising highly precise methods that scale smoothly with A, with a critical emphasis on encompassing the influence of all conceivable reaction channels, including those involving exotic particles [5].

References

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