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Large field inflation in type IIA string theory

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Understanding the physics of inflation is one of the main challenges in fundamental physics due to that inflationary dynamics is very sensitive to quantum a gravity correction; that is why crucial to understand how these corrections are controlled within a specific framework of quantum gravity. String Theory provides a well-defined quantum theory to understand gravitational and gauge interactions and hence a promising description of the physics of the early universe, it is therefore important to develop inflationary mechanism within the theory, this could yield detectable effects in the cosmic microwave background (CMB) and such effects could be detected by current and upcoming experiments, which provides us an opportunity to taste some predictions of String Theory. We propose a new scenario of large field inflation in type IIA string compactifications in which the key ingredient is a D6-brane that creates a potential for the inflaton (where the inflaton can be either a B-field axion or a D6-brane Wilson line). We compute the corrections to the effective potential of the inflaton, furthermore we find a simple mechanism to lower the inflaton mass with respect to the rest of closed string moduli stabilized by fluxes. Finally, we show that predictions for the inflationary parameters nicely fit with the current bounds from Planck collaboration.

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Numerical study of Kα X-ray emission from multi-layered cold and compressed targets irradiated by ultra-short laser pulses

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The generation of Kα X-ray produced by interaction of ultra-short laser pulses with metal targets has been studied numerically. The focusing of an ultra-intense laser beam on a solid target produces plasma on its surface. Hot electrons are generated via collective absorption mechanisms, such as resonant absorption (RA) or vacuum heating (VH). While the less energetic electrons deposit their energy in a thin front layer resulting in strong heating, the more energetic electrons penetrate much further into the target up to the colder regions behind the hot plasma where they ionize the k-shell of the atoms giving rise to the emission of "cold" Kα photons. Using Maxwell Boltzmann distribution function for hot electron and applying an analytical model, the number of Kα photons were calculated as a function of hot electron temperature, target thickness and K-shell ionization cross section. Also, simulation results of Kα yield versus target thickness variations from two and three layer metals have been presented. These calculations are useful for optimization of X-ray yield produced by irradiation of metal targets with high intensity laser pulses. Since the electrons are generated only during the interaction with the laser pulse, a very short Kα pulse of the order of the laser pulse duration is expected. The short duration makes these x-ray pulses very attractive for probing the dynamics of matter on the femto-second scale. Moreover, because of its small X-ray spot size, it has a number of interesting applications for medical imaging techniques.

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