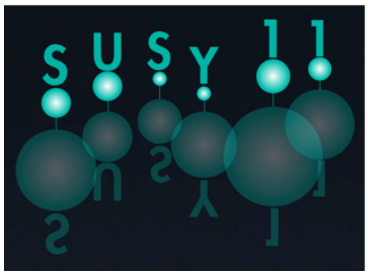

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Massive Gravitino Decays, Residual Dark Matter Annihilations, Nuclear Reaction Uncertainties and the Cosmological Lithium Problem

Monday, 29 August 2011 15:30 (20 minutes)

We consider the effects of uncertainties in nuclear reaction rates on the cosmological constraints on the decays of unstable particles during or after Big-Bang nucleosynthesis (BBN). We identify the nuclear reactions due to non-thermal hadrons that are the most important in perturbing standard BBN, then quantify the uncertainties in these reactions and in the resulting light-element abundances. These results also indicate the key nuclear processes for which improved cross section data would allow different light-element abundances to be determined more accurately, thereby making possible more precise probes of BBN and evaluations of the cosmological constraints on unstable particles. Applying this analysis to models with unstable gravitinos decaying into neutralinos, we calculate the likelihood function for the light-element abundances measured currently, taking into account the current experimental errors in the determinations of the relevant nuclear reaction rates.

We also report a preliminary result about the effects of the residual late-time dark matter particle annihilations during and after BBN on the predicted cosmological abundances of the light elements. Within the constrained minimal supersymmetric extension of the Standard Model (CMSSM) with a neutralino lightest supersymmetric particle (LSP), we find negligible effects on the abundances of Deuterium, 3He, 4He and 7Li predicted by homogeneous BBN, but potentially a large enhancement in the predicted abundance of 6Li.

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