Rev. Mexicana Astron. Astrof., 14, 71 (1987)

IN SEARCH OF PRIMORDIAL HELIUM

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ABSTRACT. The primordial abundance of ^{4}He provides a crucial test of the consistency of the standard, hot big bang model of cosmology. To fully exploit the very high quality recent data on helium in extragalactic HII regions, it is crucial to reduce the current uncertainty in the correction which must be made for stellar produced ^{4}He. Since carbon is produced (mainly) by intermediate mass stars ($M \lesssim 8\ M_\odot$) and oxygen (mainly) by massive -and, therefore, very short-lived-stars ($M \gtrsim 8\ M_\odot$), carbon should be a more reliable indicator of the level of chemical pollution by the debris of stellar evolution. In comparing Y with $[C] \equiv 10^4 (C/H)$, it is found that: $\Delta Y \cong 0.02[C]$. For those HII regions with $[C] \lesssim 0.2$ (such as the SMC), the correction to the primordial abundance is as small as or, smaller than, the other observational uncertainties. Current high quality data then suggests that the primordial mass fraction of ^{4}He is: $Y_p = 0.235 \pm 0.012$("3σ"); the implications of this result for cosmology and particle physics will be discussed.

Key words: COSMOLOGY

DISCUSSION

PEIMBERT: Which would be the consequences for the conventional big-bang model of taking the lower limit for Y_p instead of the upper one, i.e., $Y_p = 0.223$?

STEIGMAN: The lower limit is of no relevance to cosmology. Rather, if it could be established that the upper limit to Y_p is less than ~ 0.238, then the standard big-bang model is in trouble.

PEIMBERT: Which are the observational constraints on the mass of the tau neutrino?

STEIGMAN: At present, the laboratoy (accelerator) limit to $m(\nu_\tau)$ is ≤ 70 MeV. In combination with several (indirect) arguments from astrophysics and cosmology, this strongly suggest that $m(\nu_\tau) << 1$ MeV and, hence, $N_\nu \geq 3$.

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