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Atomic physics challenge. Testing the primordial He abundance.

Measurement of the primordial abundances of the lightest elements is one of the three decisive tests of Big Bang cosmology minutes after the Big Bang, and how their abundances vary with cosmological parameters. The predicted range in the He/H abundance ratio is not large, so it must be measured with a precision approaching 1% if a definitive cosmological test is to be made. The abundance ratio is measured in low-metallicity H II regions by using H I and He I recombination lines. Both H I and He I radiative recombination effective rate coefficients must be known to at least this 1% precision. Between the various uncertainties of the theoretical data, rate coefficients for collisions are the most uncertain. One of the most prominent uncertainties is on l-changing slow heavy impact collisions. Different l-changing data differ about a dex. We have used Cloudy to simulate He I and H I emissivities using the different data and found differences up to 10% in emission line intensities. Solid arguments take us to recommend one set of data over the others.