Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

**Femtosecond laser frequency comb for precision astrophysical spectroscopy** ALEX GLENDAY, CLAIRE CRAMER, Harvard-Smithsonian CfA, ANDREW BENEDICK, MIT, CHIH-HAO LI, Harvard-Smithsonian CfA, FRANZ X. KAERTNER, MIT, DAVID F. PHILLIPS, ANDREW SZENTGYORGI, RONALD L. WALSWORTH, Harvard-Smithsonian CfA — Spectroscopy is a crucial tool for cosmology and the search for extrasolar planets. Broadband frequency combs have revolutionized precision spectroscopy in the laboratory with absolute frequencies determined to better than one part in $10^{15}$. Good long-term stability and reproducibility are also major advantages of the frequency comb. However, their application to any astrophysical spectrograph requires increasing the comb-line spacing by at least 10-fold from today's high repetition rate sources operating at about 1 GHz. We report measurements of a 39-GHz comb generated from a 1-GHz source using the TRES spectrograph at the Fred Lawrence Whipple Observatory. Repeated measurements show that we can reach the expected stability limit of the spectrograph. The application of this novel technique to astrophysics should allow more than a 10-fold improvement in Doppler-shift sensitivity, with significant impact to many fields, including the search for extrasolar Earths, the direct measurement of the universe expansion and the detection of the temporal variation of physical constants.

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Date submitted: 23 Jan 2009 Electronic form version 1.4