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Diagnosis of chromospheric magnetic fields Using simultaneous Spectro-Polarimetry of Photospheric FeI and Chromospheric MgI Lines

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Abstract. Although photospheric magnetic fields have been extensively studied, how they evolve from the photosphere through the chromosphere to the corona is still an open but crucial question in solar physics. Direct measurement and diagnosis of magnetic fields and associated dynamics in higher layers especially the near force-free chromosphere can play an important role in fully understanding the three-dimensional (3D) solar magnetic fields. In this presentation, I will present a spectro-polarimetric study of NOAA AR 9661 using simultaneous observations of photospheric FeI (630.25, 630.15 nm) and chromospheric MgI (517.27 nm) lines obtained with the HAO/NSO Advanced Stokes Polarimeter. By quantitatively comparing the dynamic and asymmetric properties of Stokes profiles among the three spectral lines that form at different heights, we are able to shed new light on the 3D structure of the magnetic and flow fields in different magnetic regions (such as umbrae, penumbrae, pores, and plages). Moreover, the magnetic field vectors at multiple atmospheric heights are derived using Stokes inversion techniques, which enable us to investigate the 3D magnetic and electric current configurations with the help of field extrapolation.