Measurements of solar magnetic fields

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Over the past decade precision spectro-polarimetry of the sun has resulted in highly quantitative measurements of the magnetic field vector in the solar photosphere. These successes have revealed new understanding of how magnetic fields emerge and interact with convection to produce the variability of the sun's radiation across the spectrum, and led to the development of many new observational capabilities, both ground- and space-based. In anticipation of the revolutionary data these instruments will provide, this review highlights possible scientific advances that can be anticipated within the next few years including: magneto-convection in the presence of weak and strong fields, structure and evolution of sunspots, and measurement of magnetic fields above the photosphere.