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Remnant Echoes: Mapping the Cosmos via Large Spectroscopic Surveys[1]

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One of the major unsolved mysteries in physics is the nature of cosmic acceleration—the onset of an increased rate of expansion for our Universe about 6.5 billion years ago. Probing this cosmic acceleration or "dark energy" requires an understanding of how distances in the Universe change with time, or, in other words, constraints on the evolution of the cosmological distance-redshift relation. Redshifts are relatively straightforward to measure via large spectroscopic surveys of the sky. Distances are trickier to ascertain, however. One technique is to use the observed flux from objects of known brightness ("standard candles") in order to determine their luminosity distance. This approach, using supernovae as the standard candles, led to the first confirmation of cosmic acceleration and earned the 2011 Nobel Prize in Physics. A different but complementary approach is to use the angle subtended by tracers of known physical size in order to measure their angular diameter distances (a "standard ruler" test). Such a standard ruler, a remnant of a primordial "Baryon Acoustic Oscillation" (or BAO) is present on scales of $\sim$150 Mpc in maps of tracers of large scale structure in the Universe such as galaxies and quasars. Large spectroscopic surveys of the sky have thus emerged as a promising approach with which to constrain the acceleration of our Universe, through measurements of the apparent scale of the BAO. I will discuss my collaborative work producing extensive 3-D maps of our Universe with the Sloan Digital Sky Survey (SDSS) Baryon Oscillation Spectroscopic Surveys (BOSS and eBOSS) in order to constrain the evolution of the scale of the BAO feature. I will also outline my current efforts as part of the Dark Energy Spectroscopic Instrument (DESI) collaboration's Data Systems team. The DESI survey is an upcoming Stage IV dark energy experiment that will target over 30 million galaxies and about 2.5 million quasars in order to measure the evolution of the BAO scale throughout cosmic history.

[1]in collaboration with the SDSS-III/BOSS, SDSS-IV/eBOSS and DESI teams