LOW-FREQUENCY RADIO OBSERVATIONS FROM THE MOON: THE ESSENTIAL NEXT STEP FOR PARTICLE PHYSICS, COSMOLOGY, AND GALAXY FORMATION. Jordan Mirocha[1,2] and Steven R. Furlanetto[1], [1]UCLA, [2]mirocha@astro.ucla.edu

The EDGES collaboration recently reported the first detection of a low-frequency radio signal from the "cosmic dawn," when the first stars and galaxies formed, just 100-200 million years after the Big Bang. The amplitude of the signal, which is generated by neutral hydrogen gas in the intergalactic medium, is ~2.5x stronger than the strongest allowed signal in standard cosmologies. As a result, a variety of exotic explanations have surfaced, including milli-charged or decaying dark matter, early dark energy, and enhanced radio production in the first galaxies by stars and/or black holes. Future observations from the lunar far side may be the only way to distinguish these models, and thus simultaneously resolve outstanding issues in particle physics, cosmology, and galaxy formation. Apart from the potential for independent tests of the EDGES measurement in a pristine radio-quiet environment, observations from the lunar far side will open a new window into the Universe at frequencies below 20 MHz, which are inaccessible from the ground due to the Earth's ionosphere. Such frequencies probe the Universe when it was less than 30 million years old, before star and galaxy formation had likely begun, thus providing a clear test between astrophysical explanations for the EDGES signal and explanations that appeal to new physics. In this talk, I will discuss a wide variety of models that have emerged since the EDGES report in March, and their implications for future radio observatories on (or in orbit around) the Moon.