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Baryon Acoustic Oscillations and the Expansion History of the Universe

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The tiny inhomogeneities left over from the inflationary phase seeded the early Universe with primordial density perturbations. The photon-baryon fluid reacted to these perturbations by forming spherical pressure waves known as baryon acoustic oscillations (BAO). These waves propagated through the primordial plasma until the Universe became transparent to radiation, effectively stopping the dragging of the baryons by the photons. This left the Universe with a matter overdensity at a fixed scale (the sound horizon: 480 million light years) which was later imprinted in the galaxy distribution. This characteristic scale has been used for the past 10 years as a "standard ruler" to constrain the relation between the distance to astrophysical objects and the redshift of their photons due to the Universe's expansion. This is known as the distance-redshift relation, which encodes the expansion history of the Universe. Modern galaxy surveys such as the Baryon Oscillation Spectroscopic Survey (BOSS) are playing a key role in determining this relation with high precision, allowing us to place strong constraints on the recent phase of accelerated expansion of the Universe and therefore on dark energy. I will describe the current state of the art of BAO measurements and discuss their implications on the standard cosmological model.

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