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Galaxy-dark matter connection of photometric galaxies from the HSC-SSP Survey using weak lensing

In the paradigm of hierarchical structure formation, galaxies are thought to form and evolve inside a potential well environment of 'collisionless' and 'only gravitationally interacting' form of matter; the dark matter halos. These dark halos have formed at the peaks of initial density fluctuations due to gravitational instability and as observations have revealed, are the sites of most of the galaxy formation and evolution. Quantifying the presence of these dark structures of halos by using available galaxy surveys itself is an important and challenging task. This information can then be used to find out the connection between the galaxy and its host halo properties. Our current understanding of the structure formation and evolution is driven by simulations. At large scales the full hydrodynamic simulations are not feasible due to computational cost. However using empirically derived galaxy-halo connections, semi-analytical models of structure formation can constrain the effectiveness of physical processes as a function of redshift and bypass the need of full simulation from scratch. In our work, we estimate the masses of dark matter halos which host the photometric galaxies from HSC survey (the lens galaxies) by using the 'weak gravitational lensing' phenomenon. Weak lensing being purely gravitational phenomena, directly and fully probes the total matter content responsible for lensing of the background source galaxies. We infer the 'halo mass - stellar mass' relation and its evolution as a function of redshift within 0.3-0.8 and stellar masses. This work also demonstrates the potential of wide photometric surveys like HSC survey, for putting observational constraints on galaxy-halo connection via statistical studies like weak lensing.

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