

X22a Distant irregular galaxies to local elliptical galaxies

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Although much has been elucidated on the present-day galaxies, little has been revealed on the embryonic galaxies. For instance, elliptical galaxies or bulges in disk galaxies are found, at the present epoch, to be chemically-enriched and well-evolved systems with the age higher than 10^9 years and be characterized by several key universal properties. However, it is unresolved how such galactic systems are related to distant bright objects that are recently observed in the deepest universe. To unravel the relation, we perform ultra-high-resolution hydrodynamic simulations of a galaxy, including star formation cycles and supernova (SN) explosions. We find that an early "sparkling" phase with multitudinous SN explosions at less than 3×10^8 years exhibits intense Lyman α emission from cooling shocks and well resembles Lyman α emitters (LAEs) that have been recently discovered at redshifts greater than 3. Subsequently, the galaxy shifts to a stellar continuum radiation-dominated phase within 10^9 years, which appears like Lyman break galaxies (LBGs). Hence, it turns out that LAEs and LBGs correspond to the on-going and major phases of chemical enrichment in galaxies. The stellar dynamics after the LBG phase is also pursued, and it is found that the galaxy eventually reaches the area of elliptical galaxies on the fundamental plane. The comparisons of such simulation results with the observations of elliptical galaxies allow us to conclude that LAEs and LBGs are infants of elliptical galaxies or bulge systems in the nearby universe.