

EVIDENCE FOR A SIZABLE AGE SPREAD AMONG GALAXIES FROM THE UV UPTURN PHENOMENON IN EARLY-TYPE SYSTEMS

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The suggestion of Lee (1994, *ApJ*, 430, L113) that the age spread among galaxies is responsible for the systematic variation of ultraviolet (UV) upturn among the early-type systems is confirmed here with the detailed population synthesis models. Our models suggest that the far-UV spectra of these systems are composite of hot metal-poor horizontal-branch (HB) stars (and their post-HB progeny) and metal-rich post-asymptotic giant-branch (PAGB) stars. The systematic variation of UV upturn, however, depends on the contribution from hot metal-poor HB stars and their progeny, which in turn depends on the ages of oldest stellar populations in galaxies. Consequently, our models predict that the strength of absorption features, such as C IV and Si IV, is anticorrelated with the strength of UV upturn. This is consistent with the far-UV spectra for NGC1399 and M31 obtained by the Hopkins Ultraviolet Telescope aboard the Astro-1 space shuttle mission. We note that the opposite trend is expected in other's models that favor metal-rich solution for the UV upturn phenomenon without age spread among galaxies. Our result implies a prolonged epoch of galaxy formation, in the sense that more massive galaxies (in denser environments) formed first. With the assumption that the UV upturn phenomenon is solely due to the age variations among galaxies, we tentatively estimate the difference in age between the giant ellipticals and our Galaxy to be 4 billion years or more. This suggests that the best estimate for the lower limit of the age of the Universe is close to 20 Gyrs, which of course would be in conflict with the current estimate of the H_0 together with the standard cosmological models with zero cosmological constant. The reader is referred to Park & Lee (1995, *ApJL*, in press) for details of this work.