X38a Reconstructing Galaxy Star Formation History with Present-day Galaxy Manifold

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Using dimensionality reduction techniques, we have identified a two-dimensional manifold (galaxy manifold) within the 11-dimensional space of present-day galaxy luminosities (far-ultraviolet to infrared). The many galaxy scaling laws (e.g., star formation main sequence, Tully-Fisher relation, Faber-Jackson relation, Kennicutt-Schmidt) can be understood as projections of the found galaxy manifold. We find that parametrization of the manifold explains traditional evolutionary features (star formation rates and stellar mass) very well. The ability to represent the galaxy population with just two parameters opens us with various ways to understand galaxy evolution. In this work, we demonstrate a way to reconstruct the star formation histories (SFH) of galaxies by exploring the parameter space on the manifold of present-day galaxies. The SFH reconstruction does not need assumptions of the parametric form. Instead, only requires basic physical arguments such as merging, in-situ, and ex-situ star formation to derive SFHs that agree with the current understanding of quenching.