中華民國天文學會
The Astronomical Society of the Republic of China (Taiwan)

Contribution ID: **76** Type: **Oral**

Exploring Galactic Quenching: A Comparative Analysis of Criteria and Insights into Quenching Mechanisms

Saturday, May 17, 2025 2:15 PM (15 minutes)

Galaxy quenching—the cessation of star formation—is a pivotal phase in galaxy evolution, which can occur due to various internal or external processes. Differentiating between spatial quenching patterns, such as inside-out versus outside-in modes, sheds light on the quenching mechanisms. However, the characterization of quenching modes involves how "quenched"regions are defined. In this study, we utilize a sample of ~ 10,000 galaxies from the SDSS/MaNGA survey and systematically investigate the spatial distribution of quenched areas using four commonly adopted tracers: the 4000 Å break (Dn4000), specific star formation rate (sSFR), post-starburst (PSB) criteria, and LI(N)ER regions from BPT diagrams. Our goal is to evaluate how each definition affects identifying quenching patterns. By quantifying the fraction and concentration of quenched areas within galaxies, we reveal that different tracers yield significantly different spatial quenching features: sSFR, Dn4000, and LI(N)ER-based definitions tend to indicate inside-out quenching, while the PSB tracer identifies both inside-out and outside-in patterns. These discrepancies reflect the sensitivity of each tracer to different timescales and stellar populations. Our findings emphasize that relying on a single quenching definition can lead to incomplete interpretations of quenching processes. A multi-tracer approach is thus crucial for a comprehensive understanding of how galaxies shut down star formation.

Section

Galaxy/Extragalactic

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Session Classification: Galaxies