

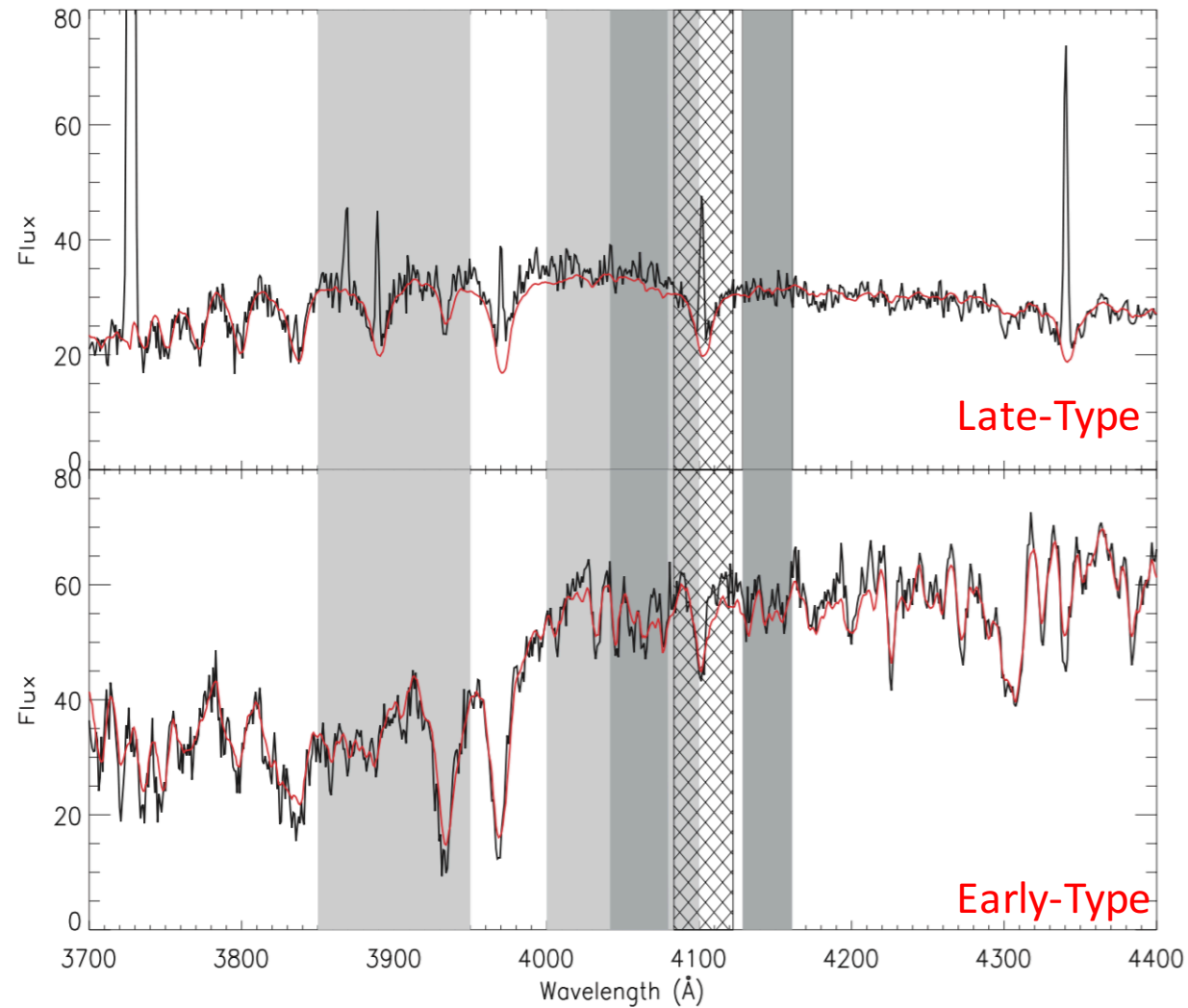
Unresolved Galaxy Properties

(Stellar masses) and [star formation histories](#) for 10^5 SDSS galaxies

Star Formation Tracer: 4000Å Break D(4000)

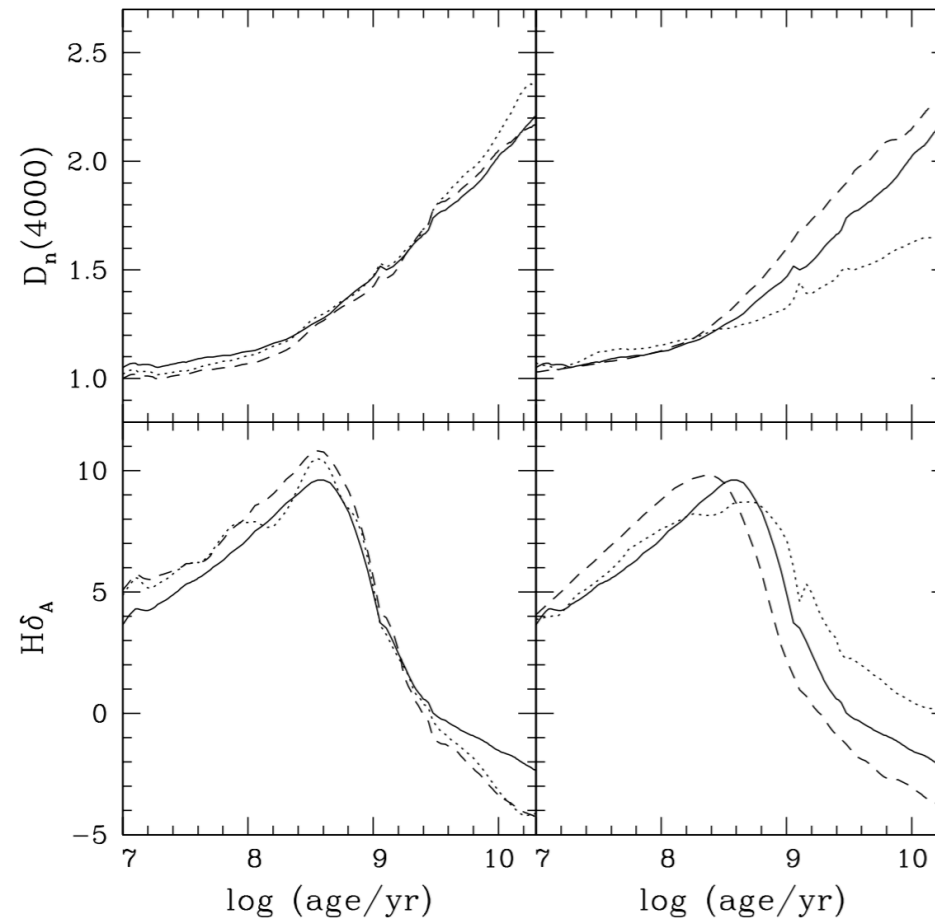
- Differentiates young and old stellar populations
- Caused by large number of absorption features around 4000Å
 - Ca Absorption Features
- Hot OB stars multiply ionize metals, reducing opacity
 - No break present due to lack of absorption
- Break smallest for young populations (late-type), largest for old metal-rich (early-type)

Star Formation Tracer: 4000Å Break



Star Formation Tracer: 4000Å Break

Post-Burst



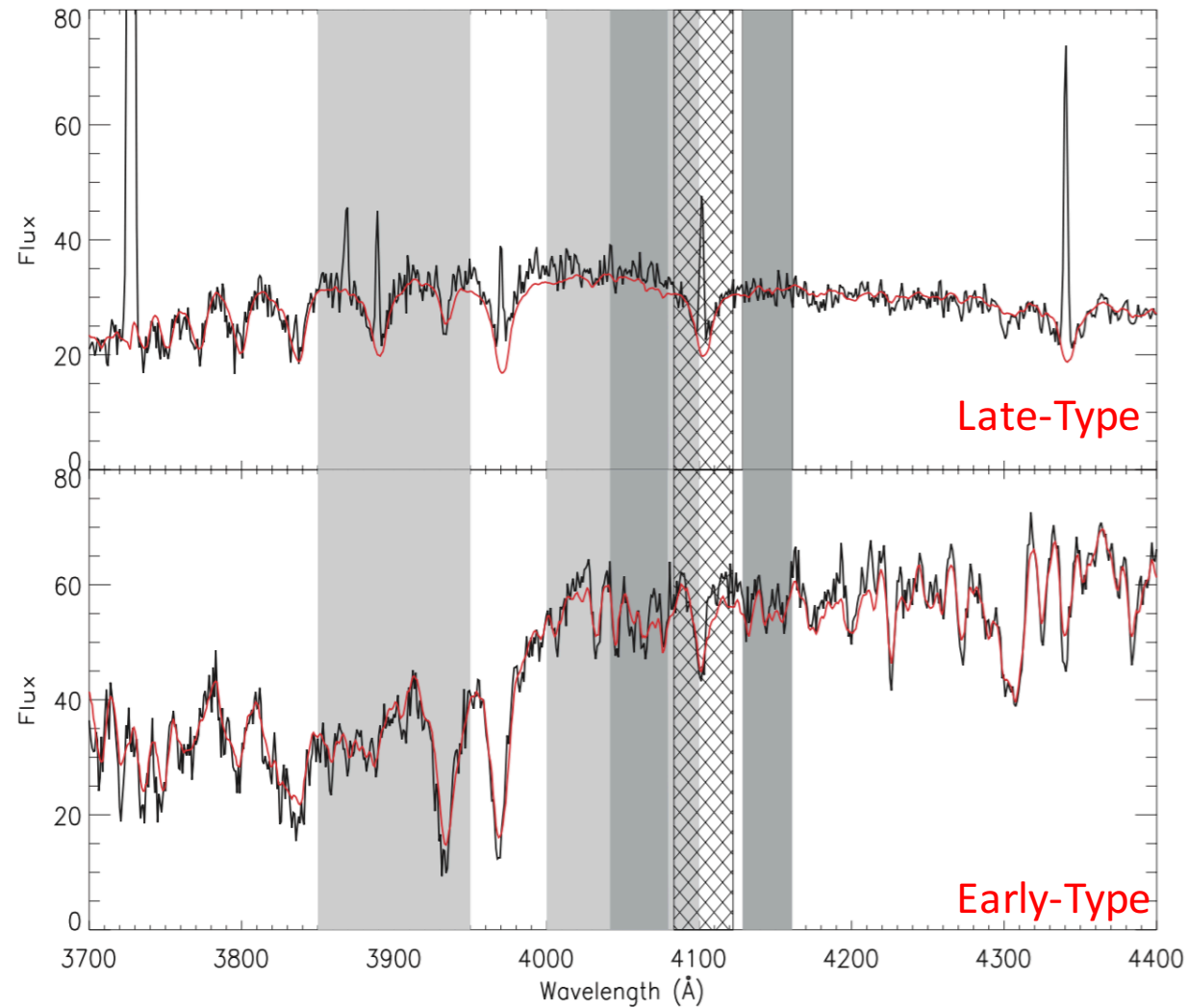
Stellar Models

Metallicity

Star Formation Tracer: $H\delta$ Absorption

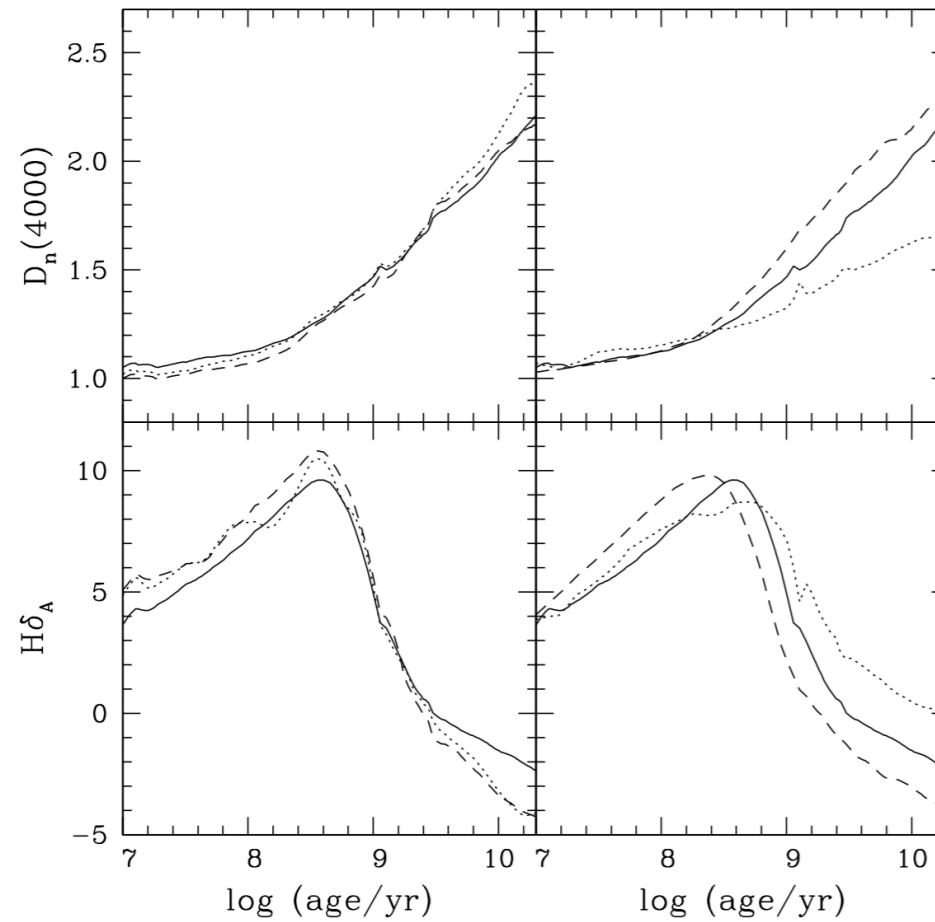
- Traces recent bursts of star formation ($\sim 0.1-1\text{Gyr}$)
- O and B stars have weak intrinsic absorption
- After their evolution, late-B to early-F stars dominate optical light
 - Have strong (relative) $H\delta$ absorption
- Need to correct for nebular emission, which are themselves attenuated by dust.
 - Can use H-alpha and H-beta emission-line fluxes to get $H\delta$ dust correction, and then subtract this from the absorption feature.

Star Formation Tracer: $H\delta$ Absorption



Star Formation Tracer: $H\delta$ Absorption

Post-Burst



Stellar Models

Metallicity

Library of Model Star Formation Histories

- Exponential SFR

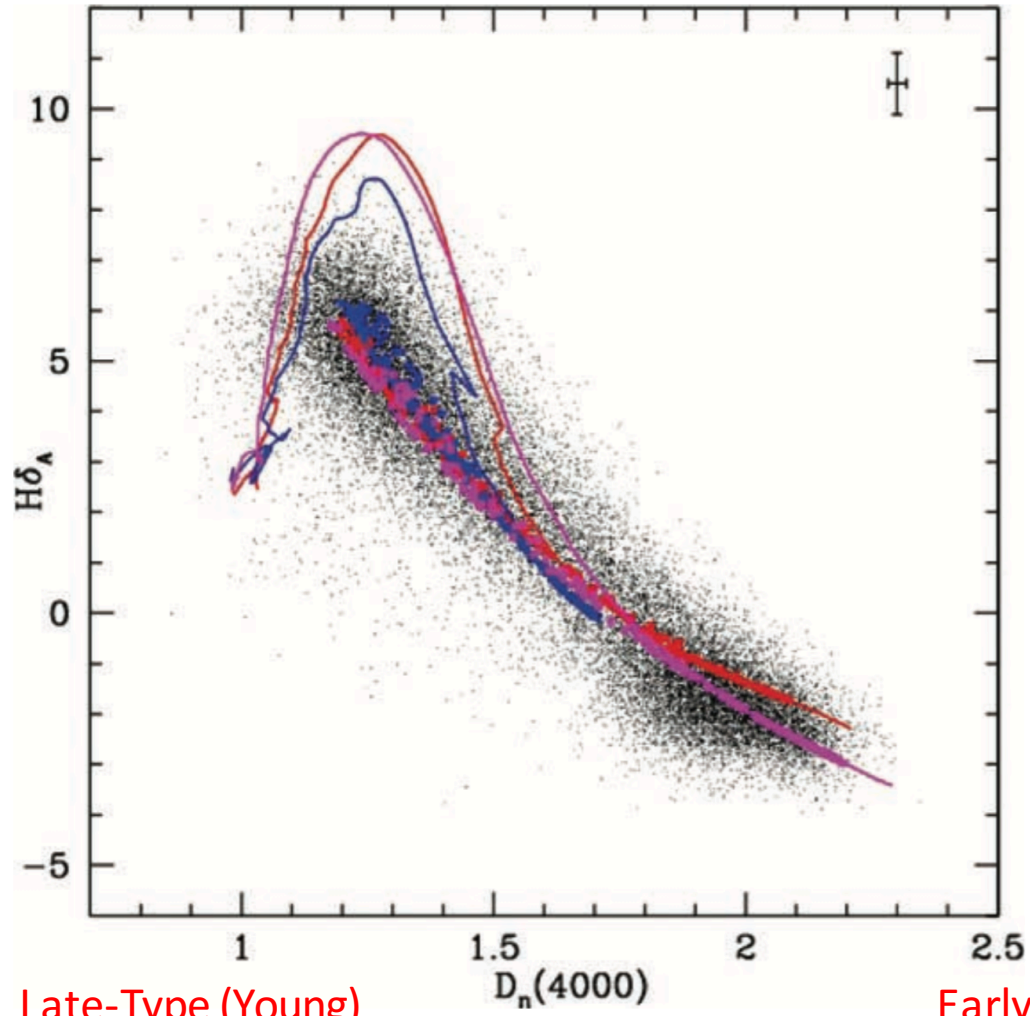
- $SFR(t) \propto \exp[-\gamma t(\text{Gyr})]$
 - From time t_{form} to present.
 - Distributed between interval from Big Bang to 1.5 Gyr before present day.
 - γ distributed over interval 0 and 1. (star formation scale parameter)

- Superimposed random bursts

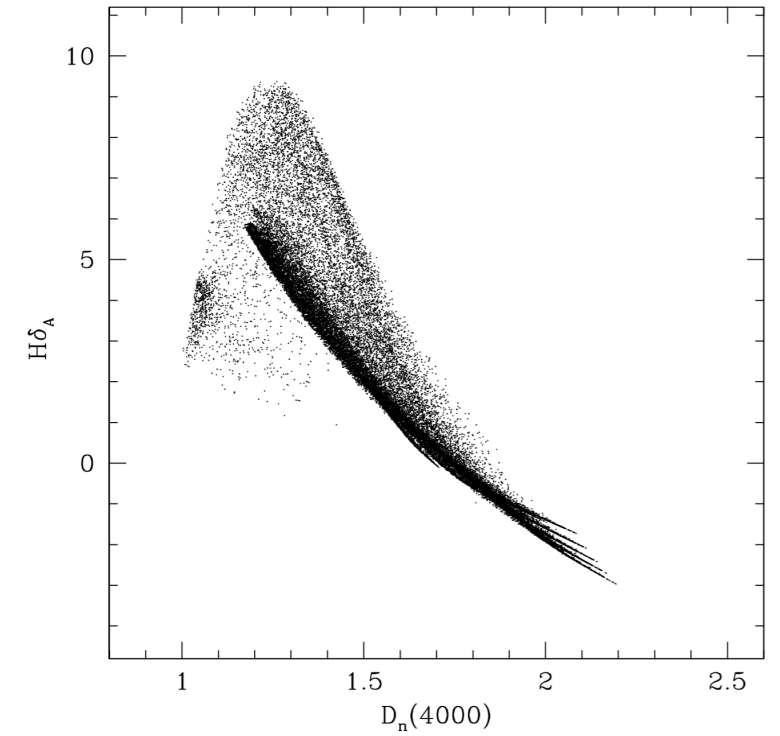
- Burst Amplitude $A = M_{burst}/M_{cont}$
 - Distributed logarithmically between 0.03 and 4.0
 - Stars form at a constant rate for a time t_{burst} between 30-300 Myr.
 - Set so that 50% of galaxies in the library have experienced a burst over the past 2 Gyr.
 - I.e. bursty and continuous star formation equally probable

H δ -D(4000) Plane

Recent SF Burst

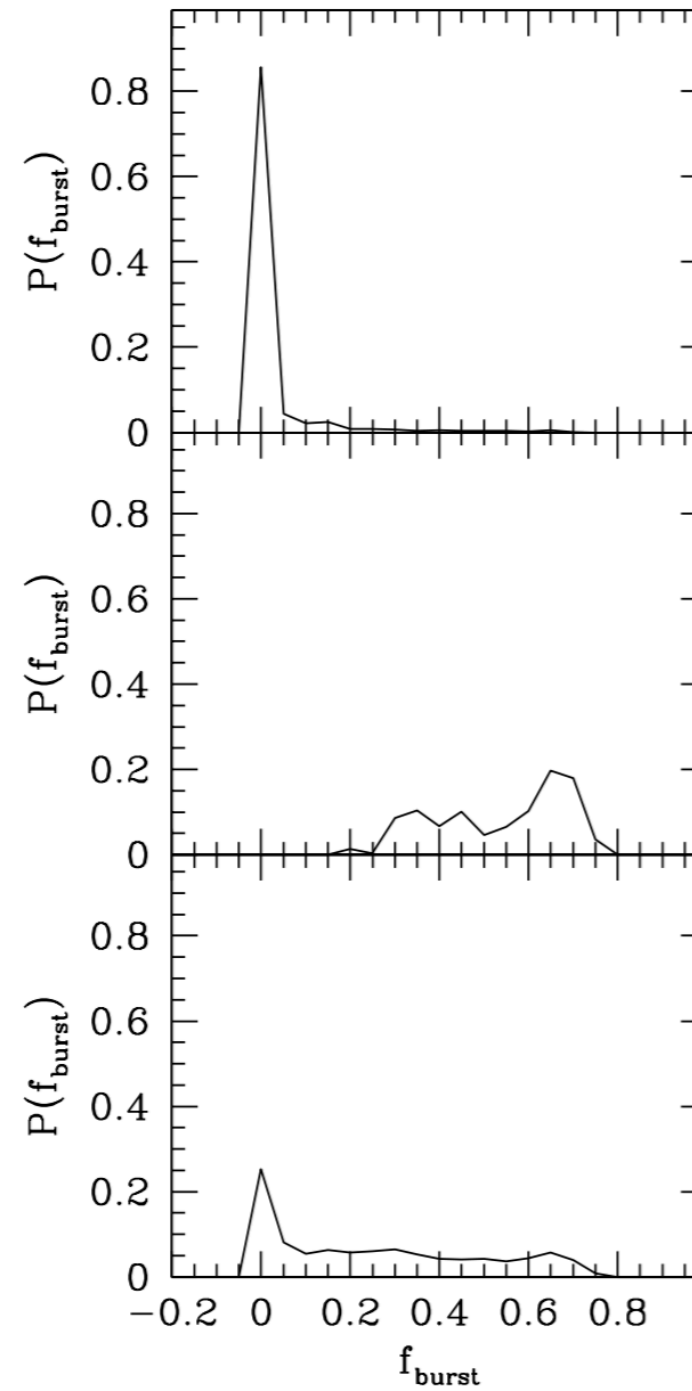
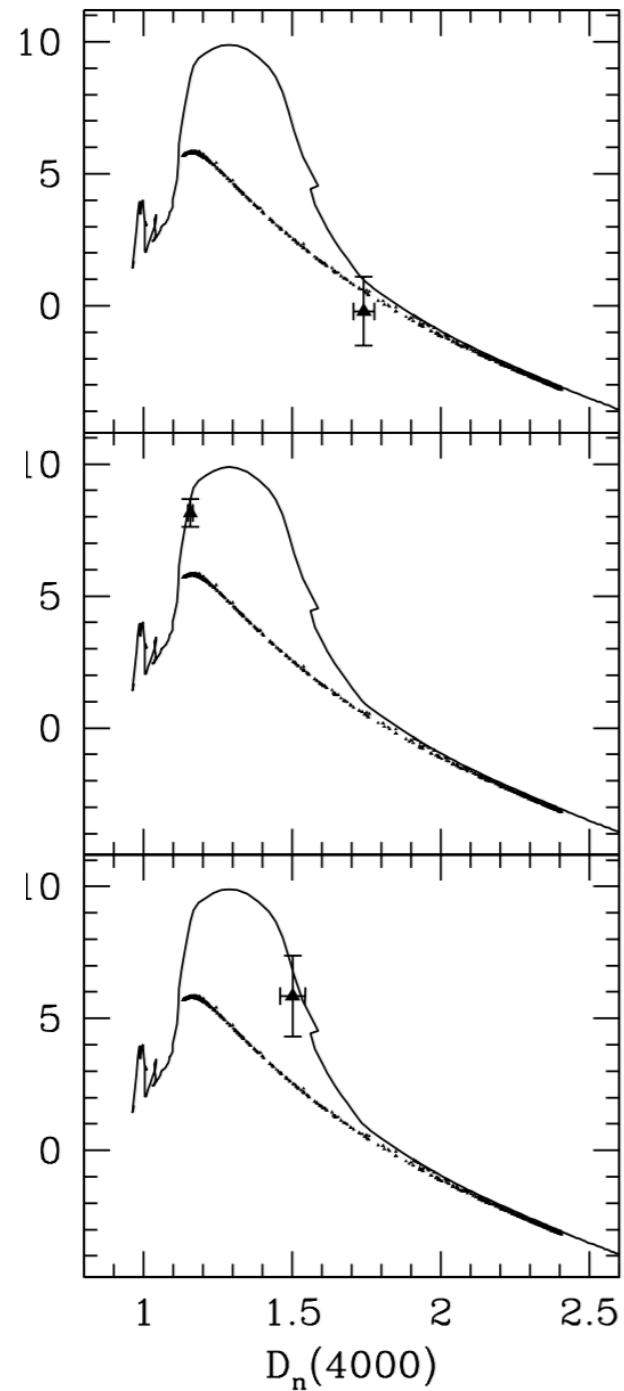
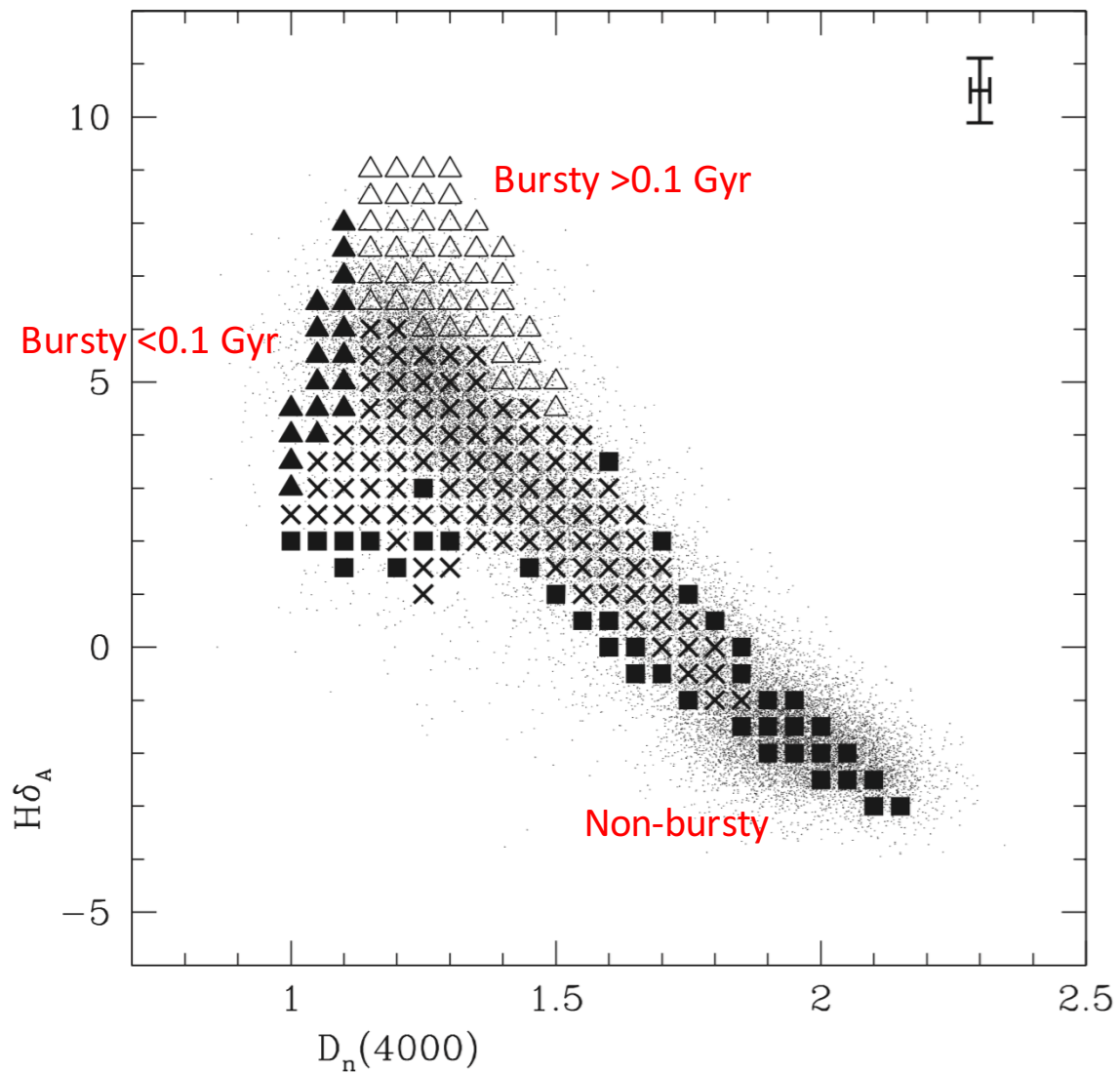


No Burst



Model Library

Burst Mass Fraction F_{burst}



Takeaways

- D(4000) differentiates between early-type (old) and late-type (young) stellar populations.
 - Young populations have a *weak* 4000Å break
 - Old populations/metal-rich have a *strong* 4000Å break
- H δ traces *recent* (~ 0.1 -1Gyr) bursty star formation
- H δ -D(4000) plane probes (bursty) star formation histories