



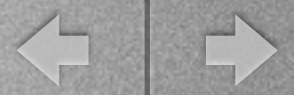
UV + Optical Properties of Type Ia Supernova Host Galaxies

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The ESSENCE Survey



Determine w to 10%

6 year project on CTIO Blanco 4m telescope in Chile

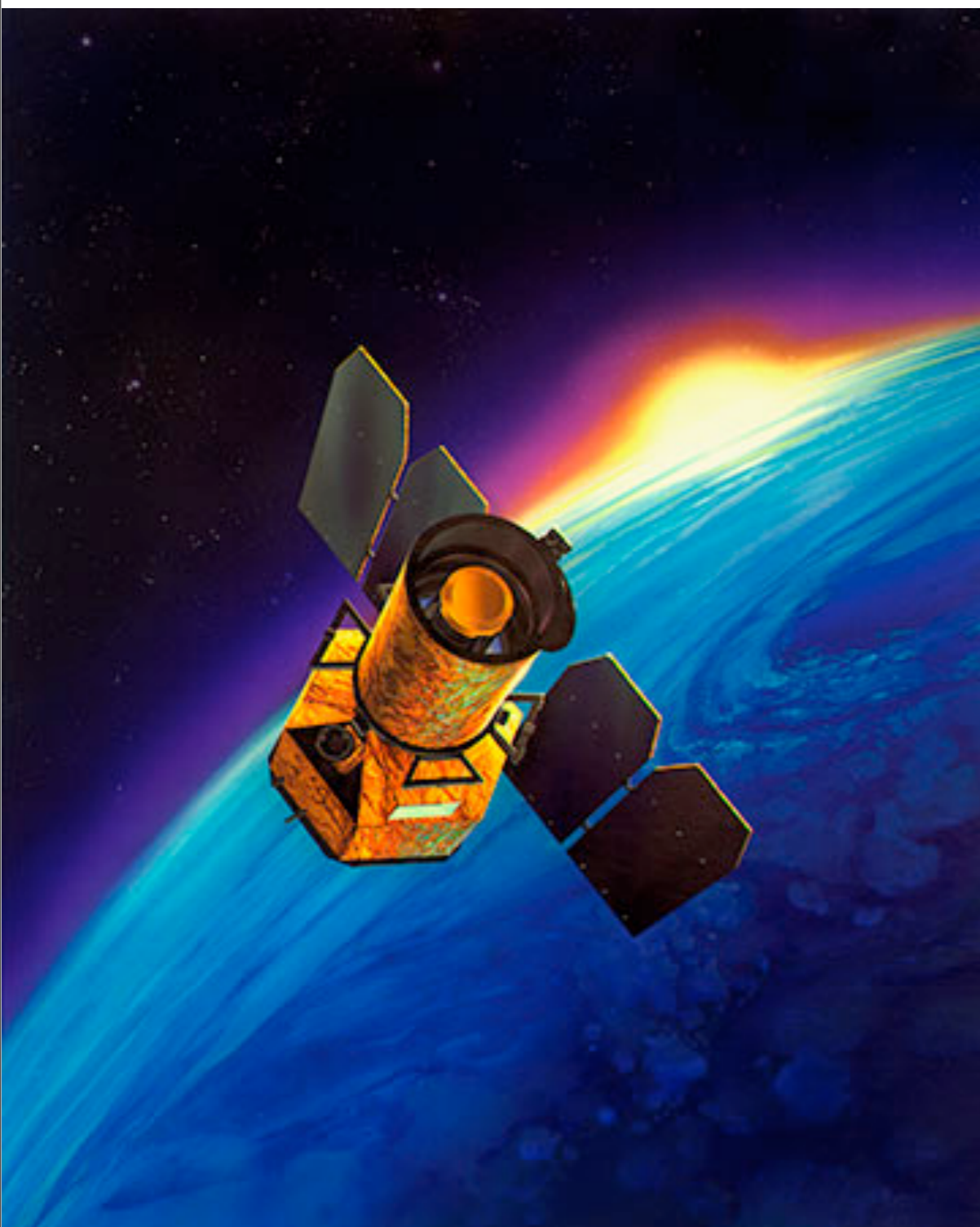
8 sq. deg. , wide field imaging in R and I

Supplemental observations in B,V, and z

Same night detection

248 SNe Ia $0.2 < z < 0.8$

Spectroscopy: Keck, Gemini, VLT, Magellan



The Galaxy Evolution Explorer

8th year NASA

FOV 1.2 sq. deg.

Filters (Simultaneous) : FUV = 152.8 nm
NUV = 227.1 nm

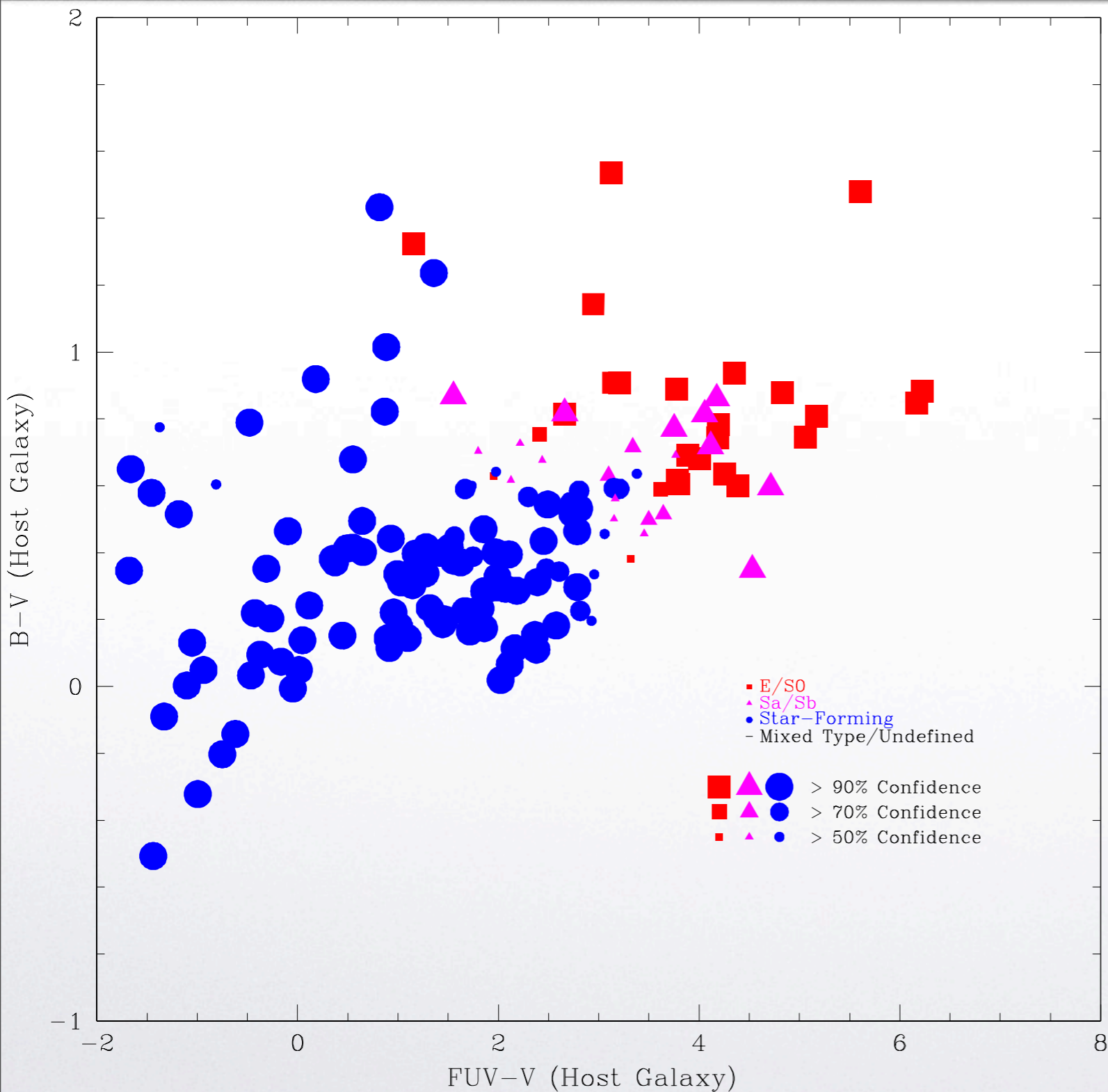
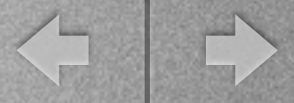
Sensitivity: FUV NUV
AIS = 19.9 20.8
MIS = 22.6 22.7
DIS = 24.8 24.4

MIS covers nearly every ESSENCE field

Cycle 6 GI time to reach DIS for all ESSENCE fields



UV + Optical SED/Color



K-Corrections + SED Fitting

Use both Vega + AB magnitudes

Can apply non-detections

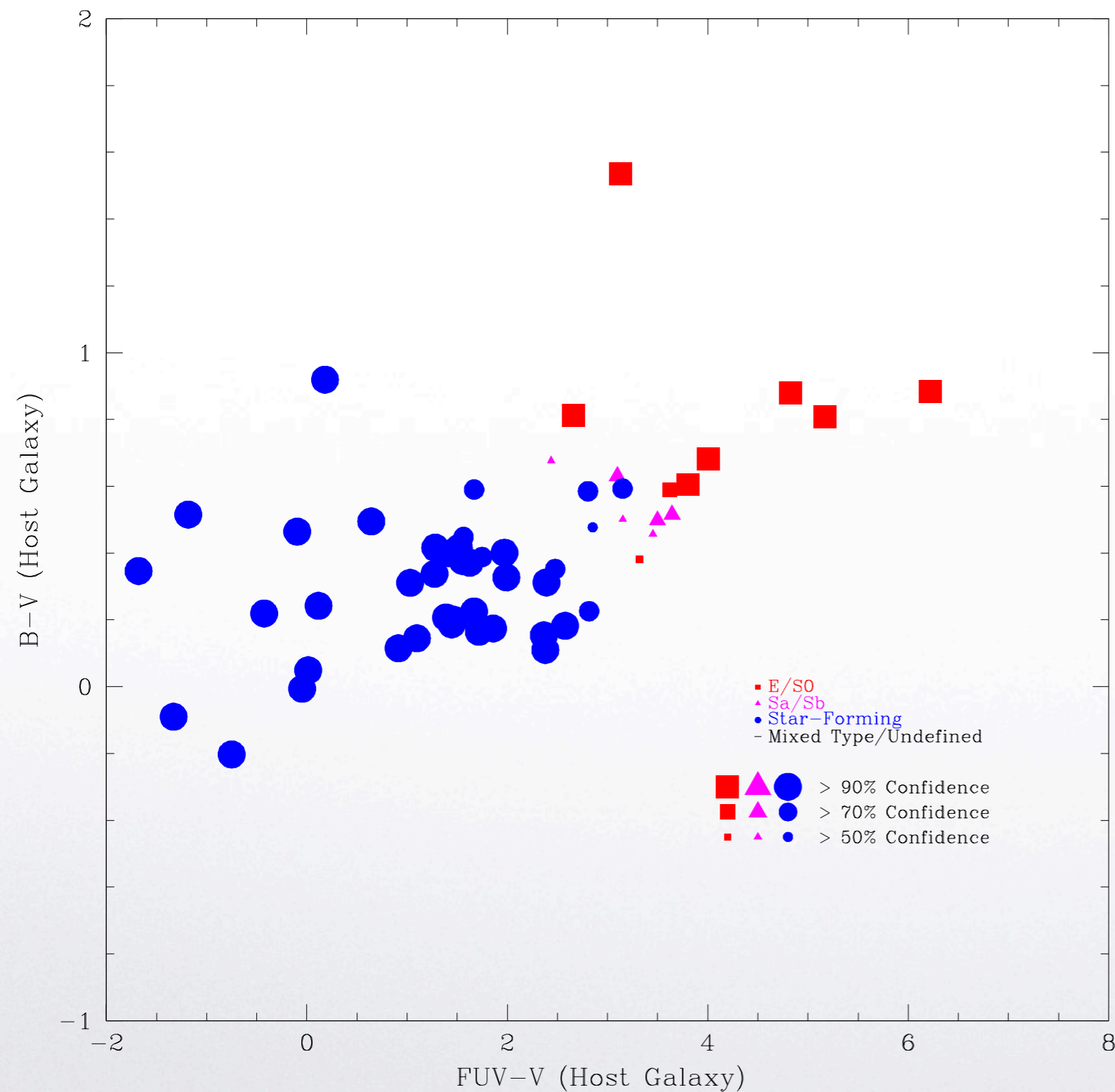
Galaxy templates from
Calzetti+94, Kinney+96

Probability fit from SED

**FUV-V better tracer of galaxy type
than B-V**



UV + Optical SED/Color Detections



K-Corrections + SED Fitting

Use both Vega + AB magnitudes

Can apply non-detections

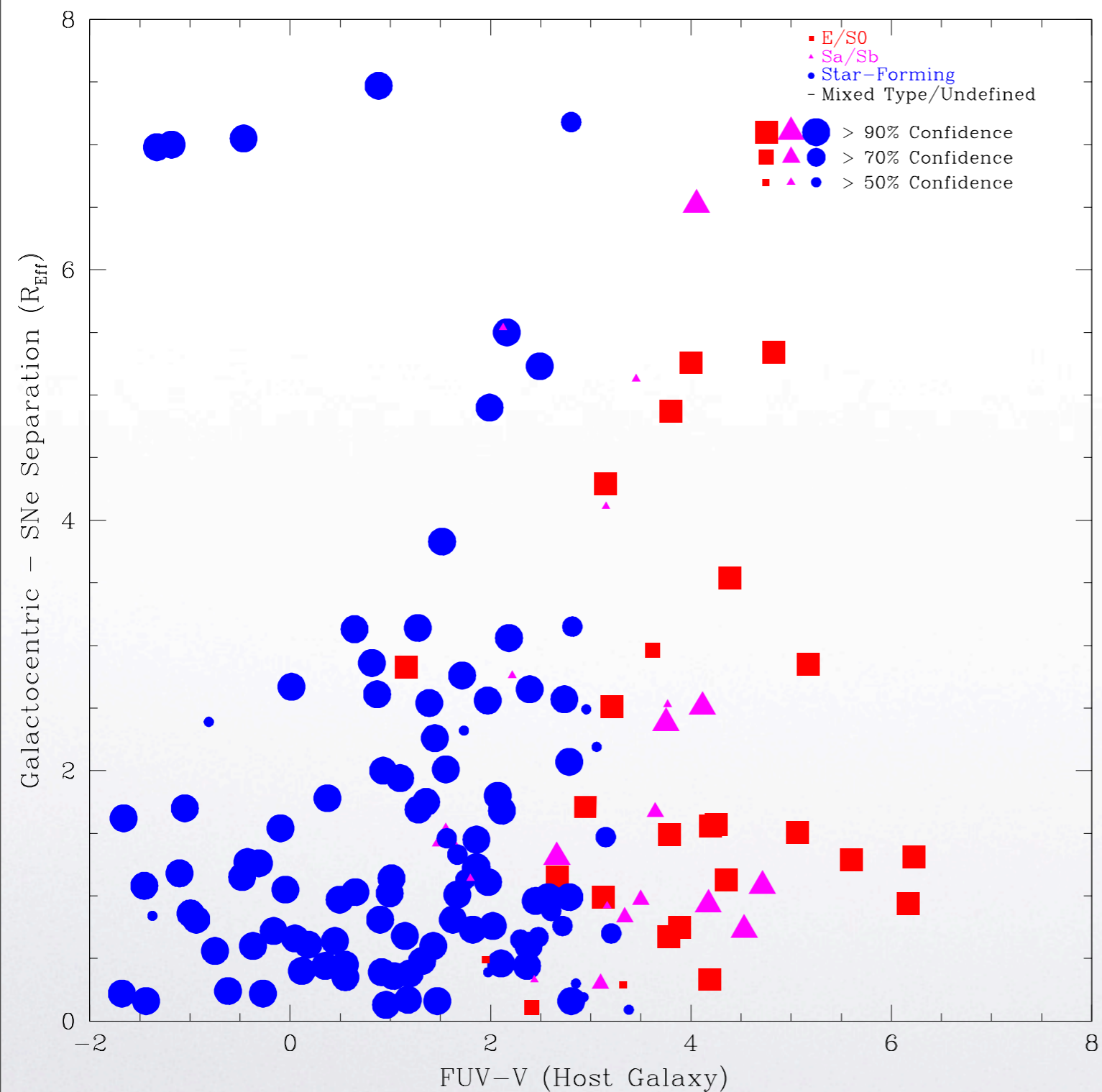
Galaxy templates from
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Probability fit from SED

**FUV-V better tracer of galaxy type
than B-V**



Supernova in the Hosts



Reff = Half-Light Radius

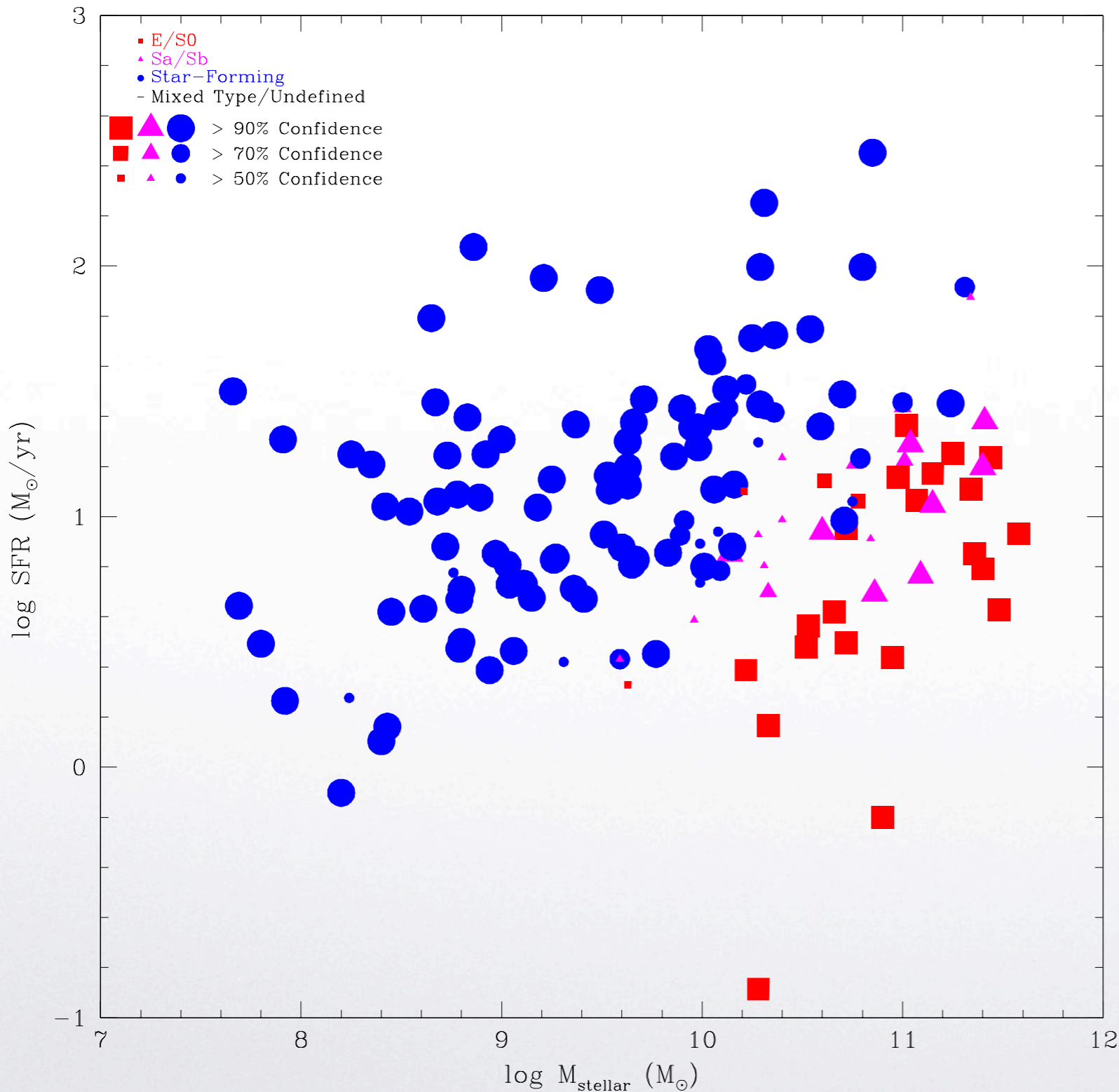
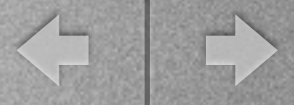
Derived from Kron radial fitting

Need prospective on galaxy type

~20% SN > 2Reff from galactic center



Direct SFR and Mass Measurements



SFR measured from observed frame GalEx NUV (Salim+07)

At $z \sim 0.5$, NUV \Rightarrow FUV

Correction needs to be applied for BHB stars

Detection of Elliptical galaxies with active star formation

3 Elliptical galaxies with current mergers

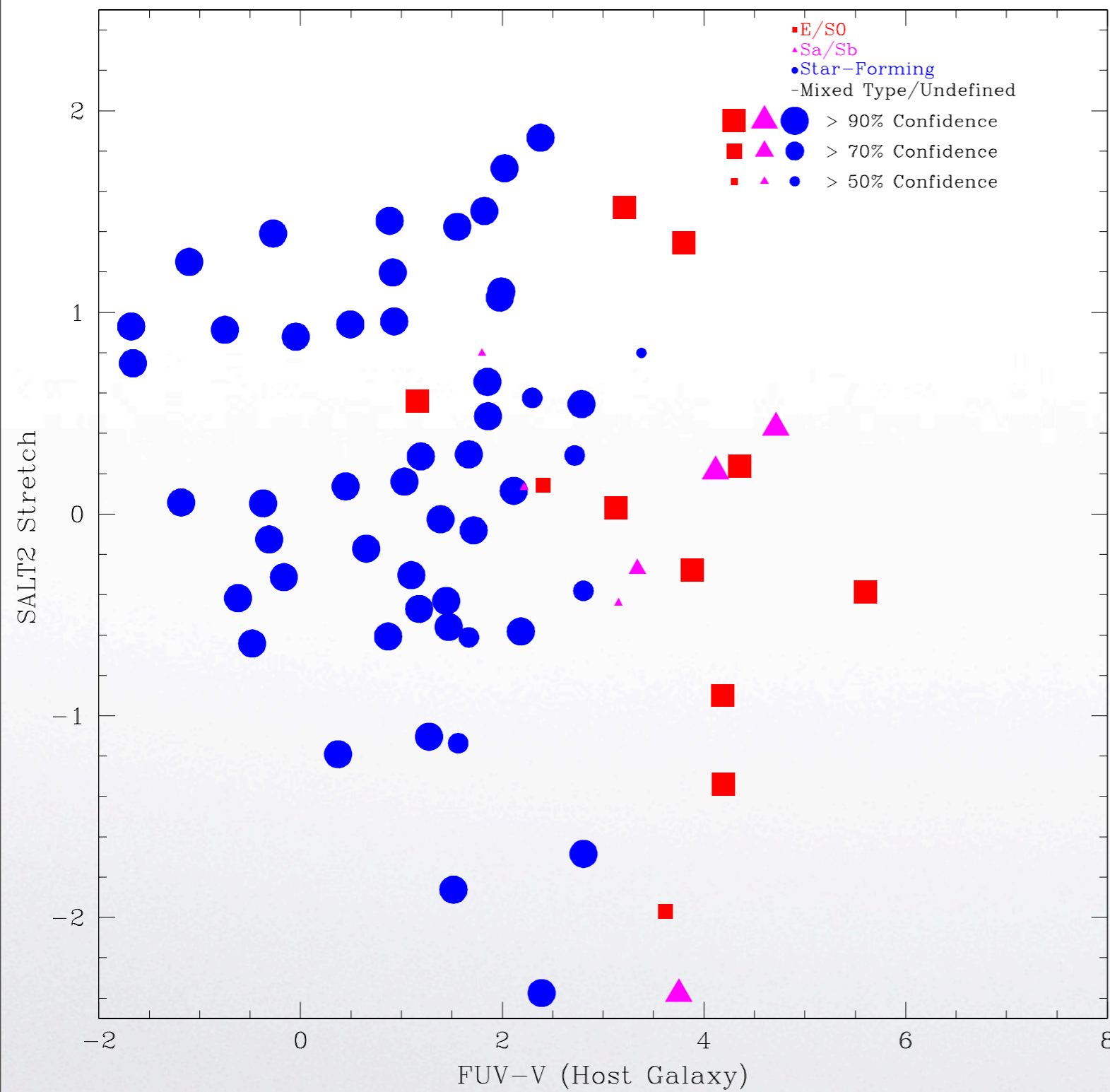
Mass derived from Bell and De Jong 01

Chabrier IMF

IMF does matter! Factor of 2



SN Type and Host Galaxy



Stretch = like curve shape

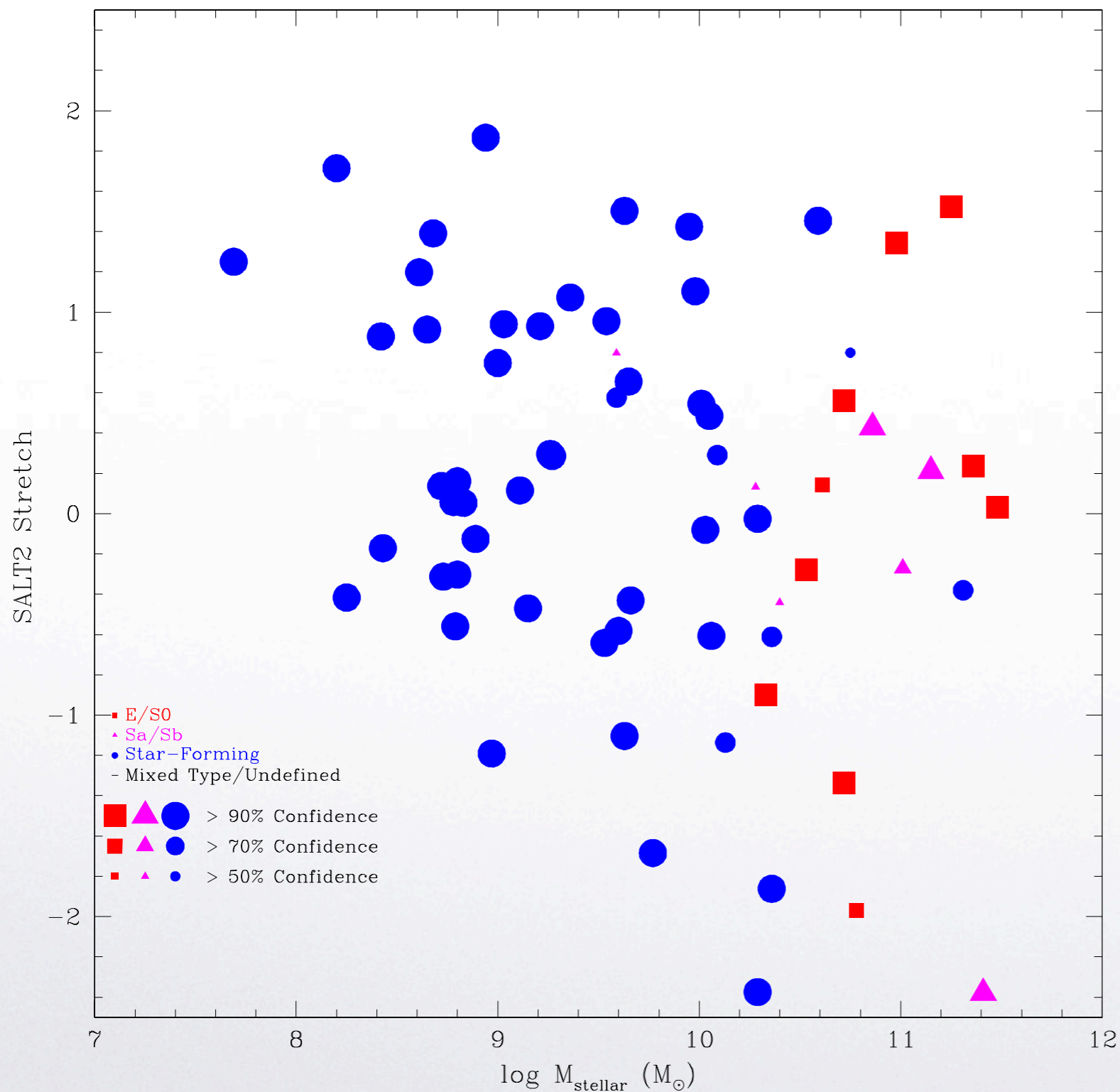
Negative stretch = fainter SN (91bg)

Similar to nearby SN

Faster declining SN occur in less star-forming, more metal rich hosts



SN Type and Host Mass



Stretch = like curve shape

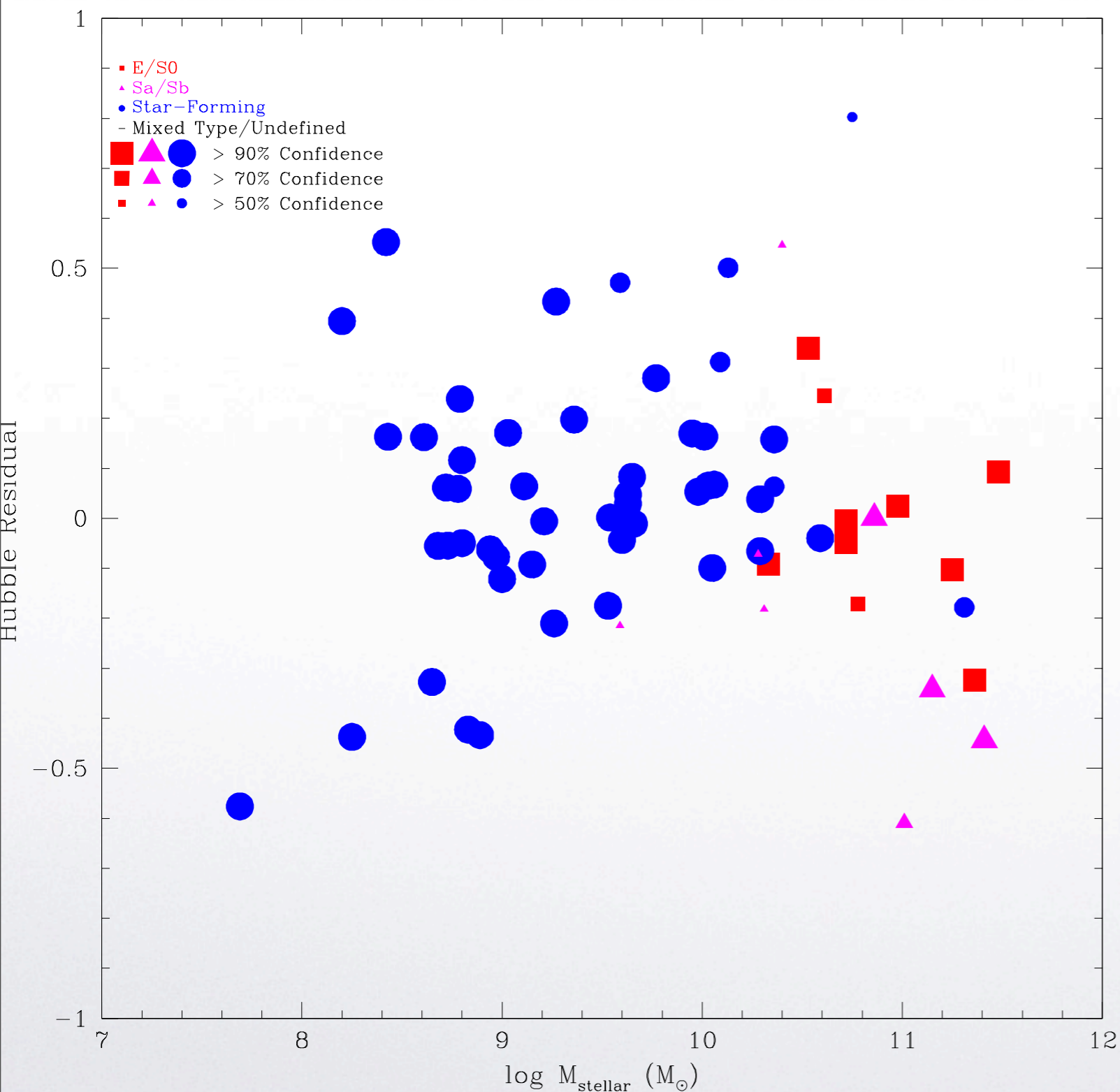
Negative stretch = fainter SN
(91bg)

Similar to nearby SN

Faster declining SN occur in more
massive, metal rich hosts



Cosmology and Host Mass



Hubble Residual = Distance
Modulus deviation from best fit

SALT2

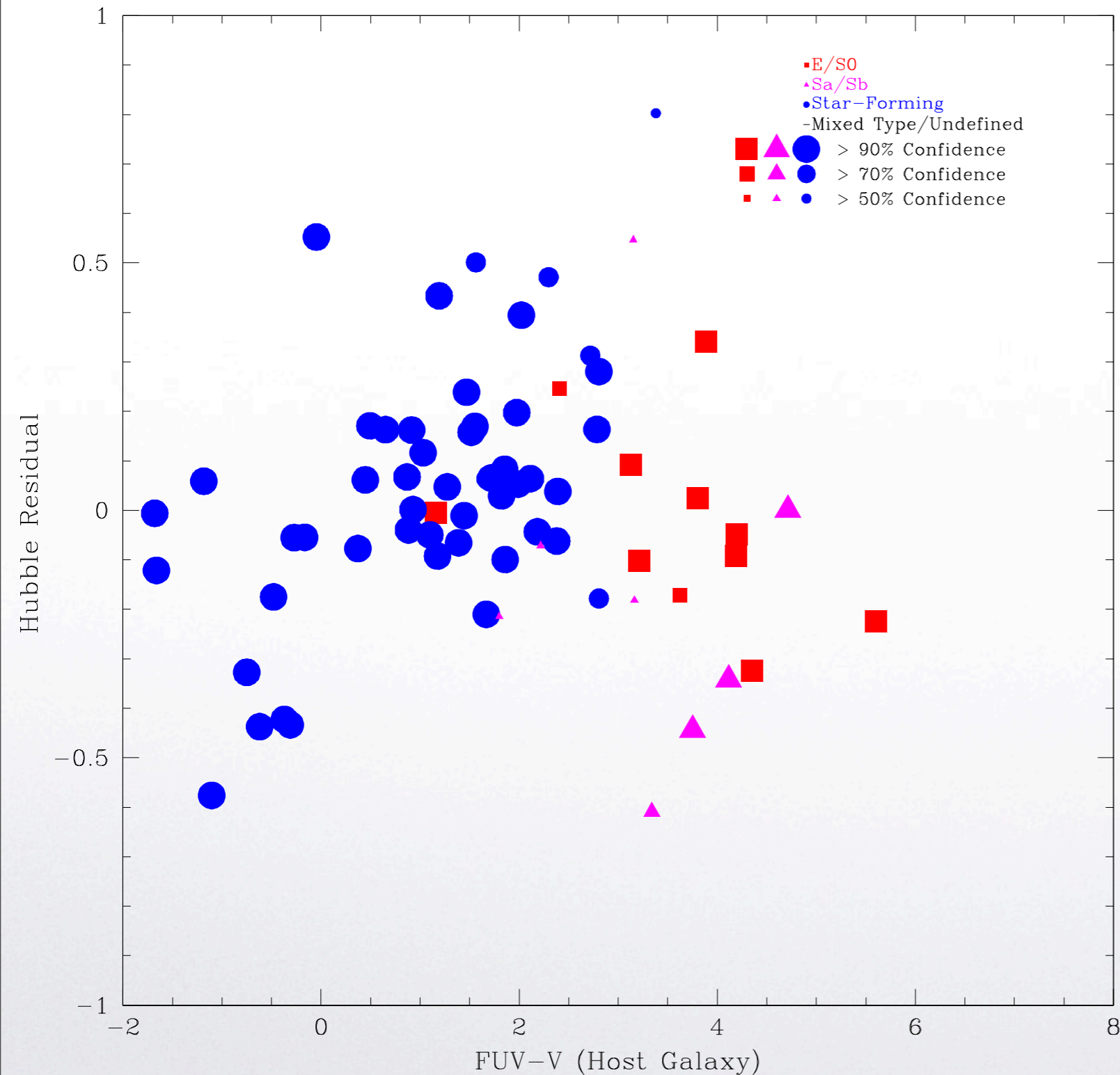
Positive Residual = fainter SN

Trends between residual and host
mass

More massive hosts have inverse
relation to less massive hosts



Cosmology and Host FUV-V



Hubble Residual = Distance
Modulus deviation from best fit

SALT2

Positive Residual = fainter SN

Trends between residual and host
mass

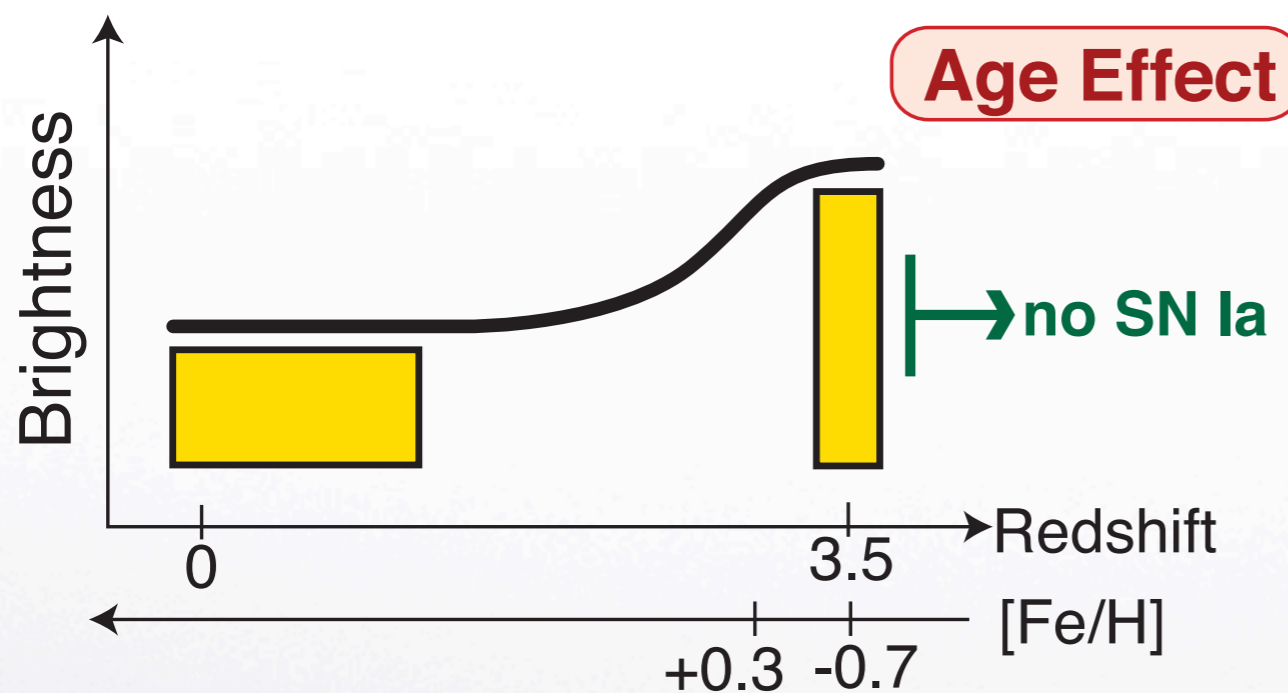
Bluer hosts have inverse relation
to red hosts



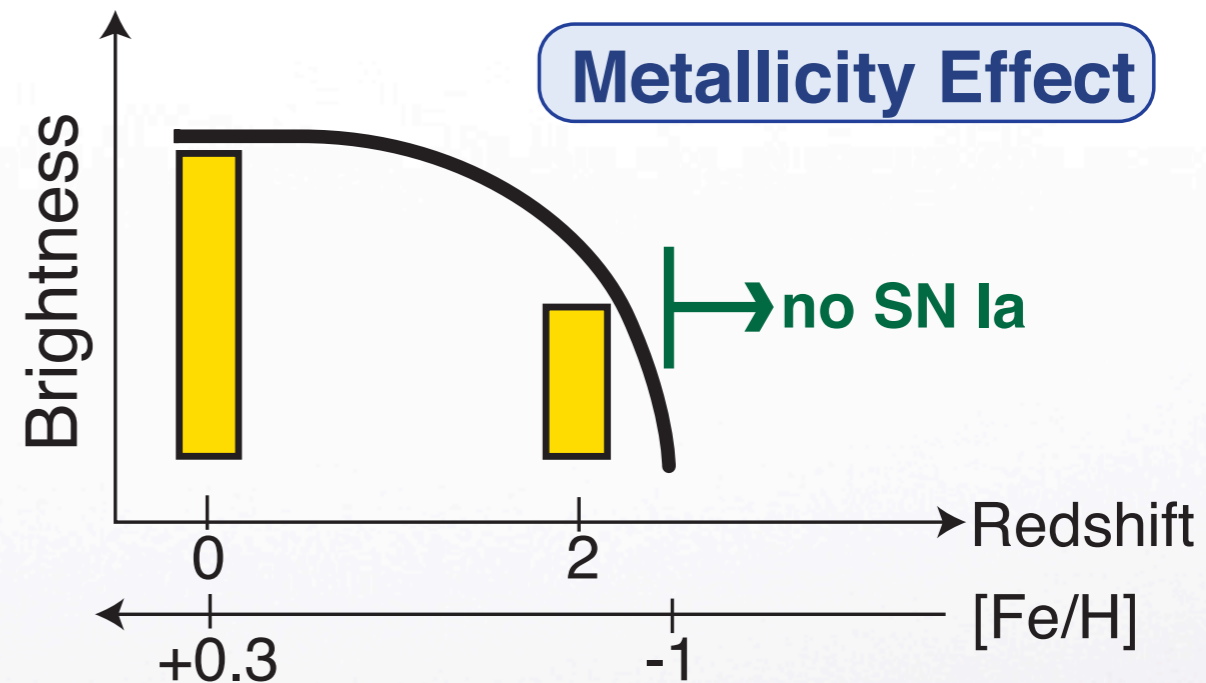
Metallicity - Age Effect



Ellipticals



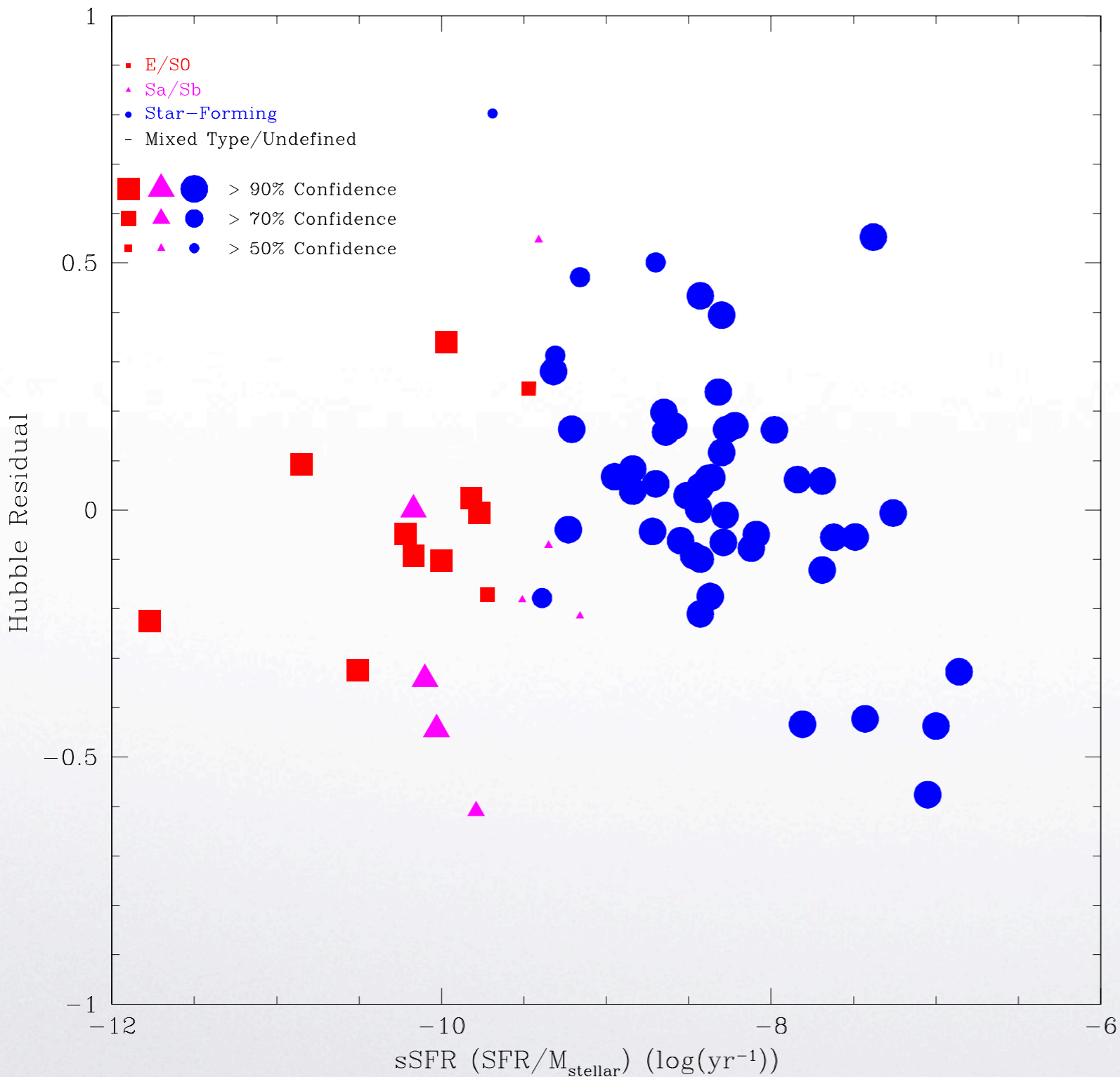
Spirals



Nomoto+ 2003



Metallicity - Age Effect



Hubble Residual = Distance Modulus deviation from best fit

SALT2

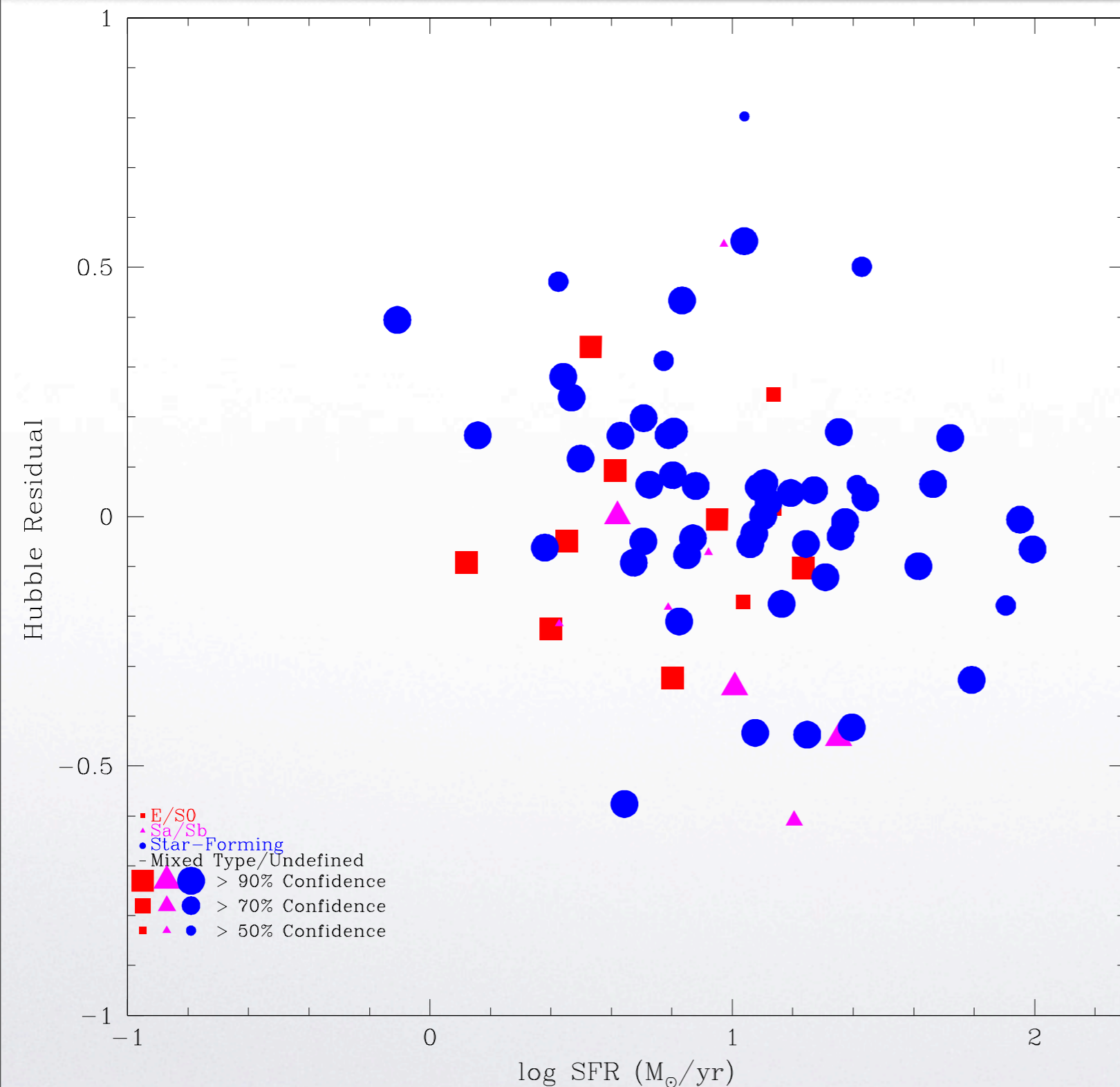
Positive Residual = fainter SN

Trends between residual and host mass

Lower sSFR hosts have inverse relation to high sSFR hosts



Star Formation Rate



Hubble Residual = Distance
Modulus deviation from best fit

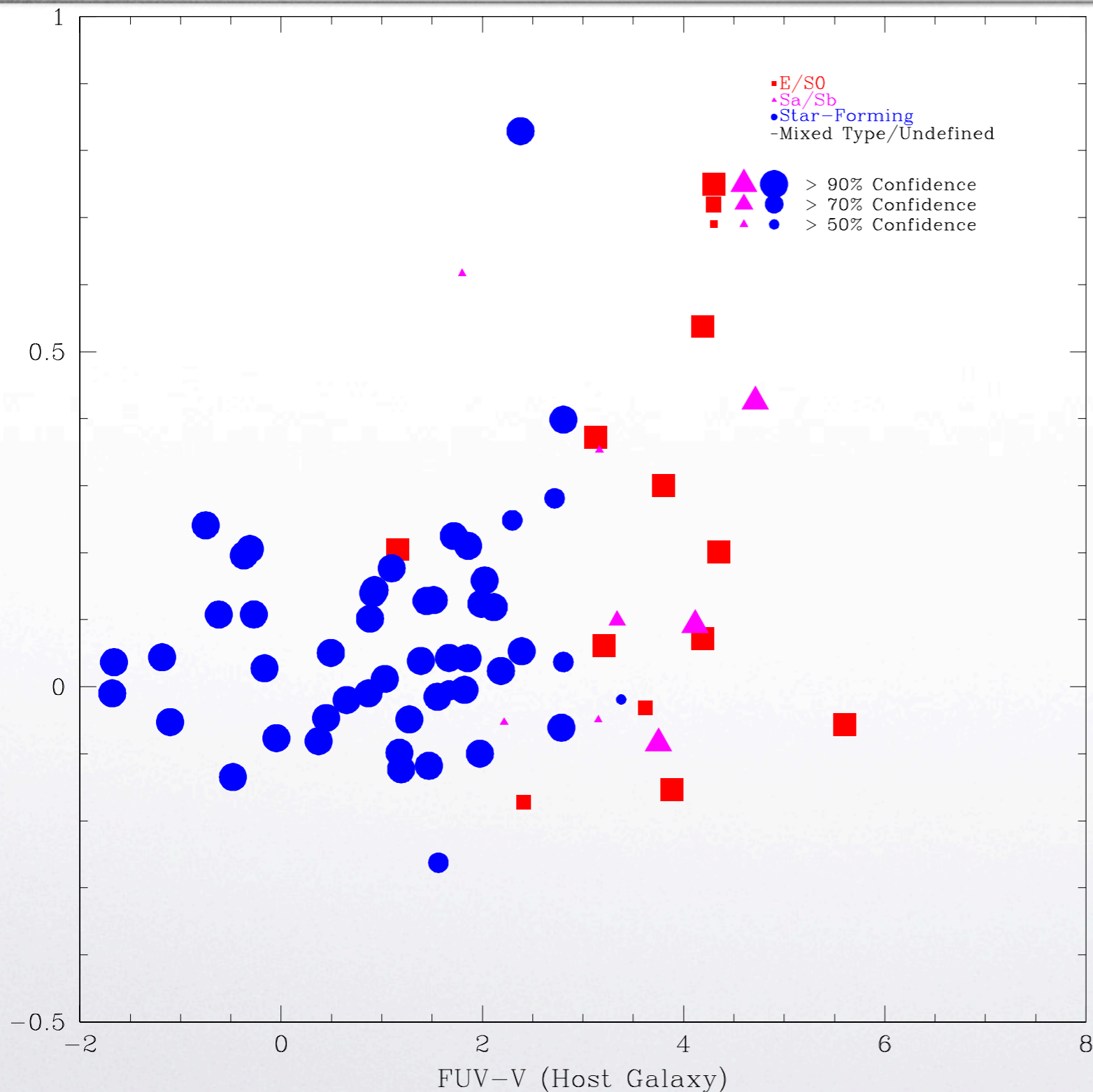
SALT2

Positive Residual = fainter SN

No Dependence on SFR



SN Color and Host Color



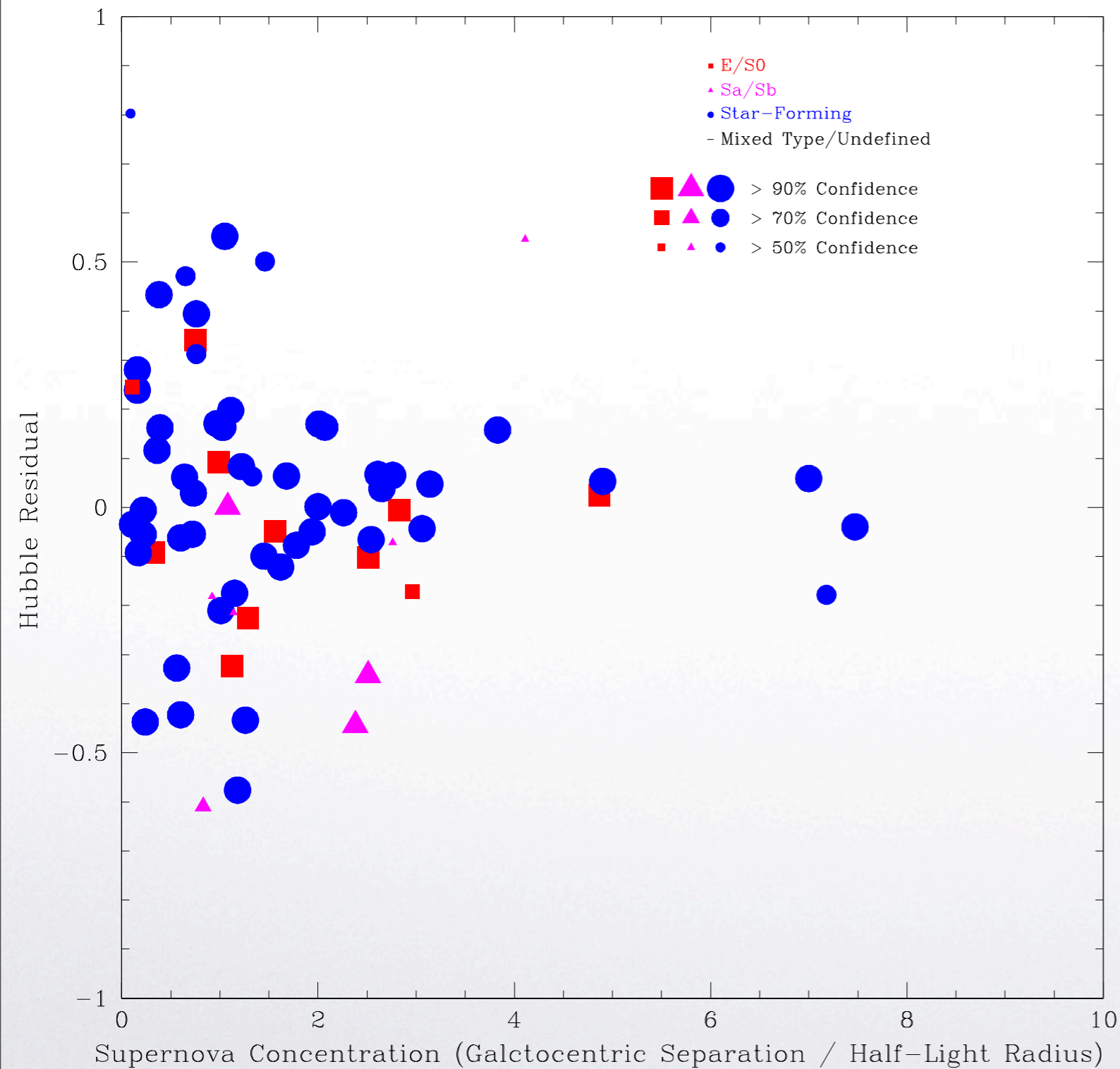
SALT2 Color = \sim extinction

If SN fitting was problematic,
should see systematic trend with
color

Lower dispersion in early-type
systems



Cosmology and SN Location



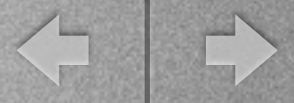
Hubble Residual = Distance
Modulus deviation from best fit

SALT2

Positive Residual = fainter SN

Distance of SN from Host
normalized by host size

Further out = less extinction, less
metallicity



Elliptical galaxies does not mean zero SFR (Gallagher+08)

As with nearby SN, the more massive, metal rich, less star forming galaxies host faster declining SN

In the less massive hosts, the same SN appears fainter while in the more massive hosts, its brighter

Similarly galaxies with lower sSFR host brighter SN while higher sSFR galaxies host fainter SN

No dependance on SFR

Active/Passive galaxies have two different relations with a clear turnover. Metallicity effect with late-type galaxies and age effect for early-type galaxies (Nomoto+2003)