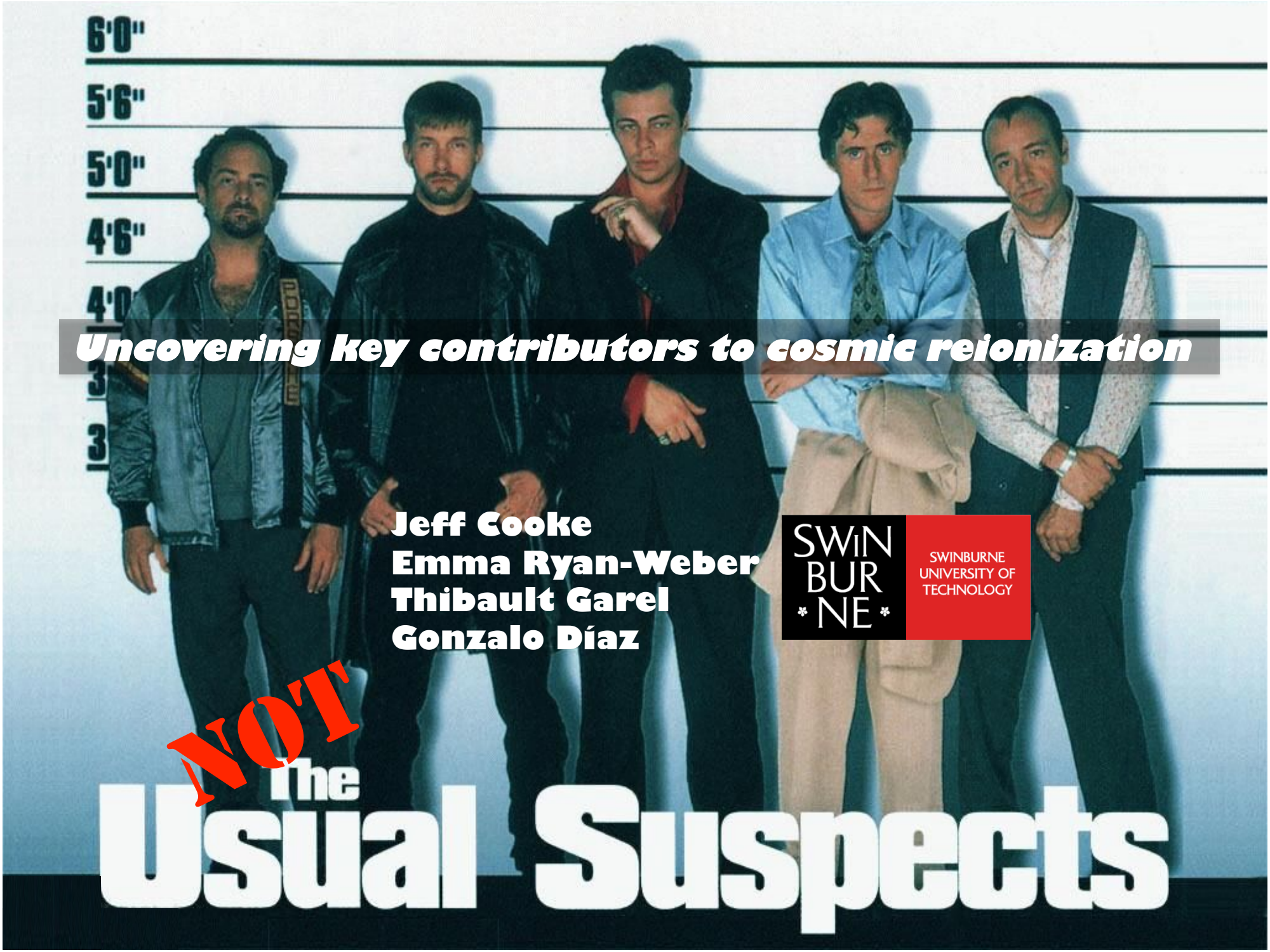

6'0"
5'6"
5'0"
4'6"
4'0"
3
3
Uncovering key contributors to cosmic reionization
Jeff Cooke
Emma Ryan-Weber
Thibault Garel
Gonzalo Díaz
SWIN BUR NE
SWINBURNE UNIVERSITY OF TECHNOLOGY
NOT
The
Usual Suspects

the crime scene

the "crime": *the universe was reionized*

- galaxies are largely responsible

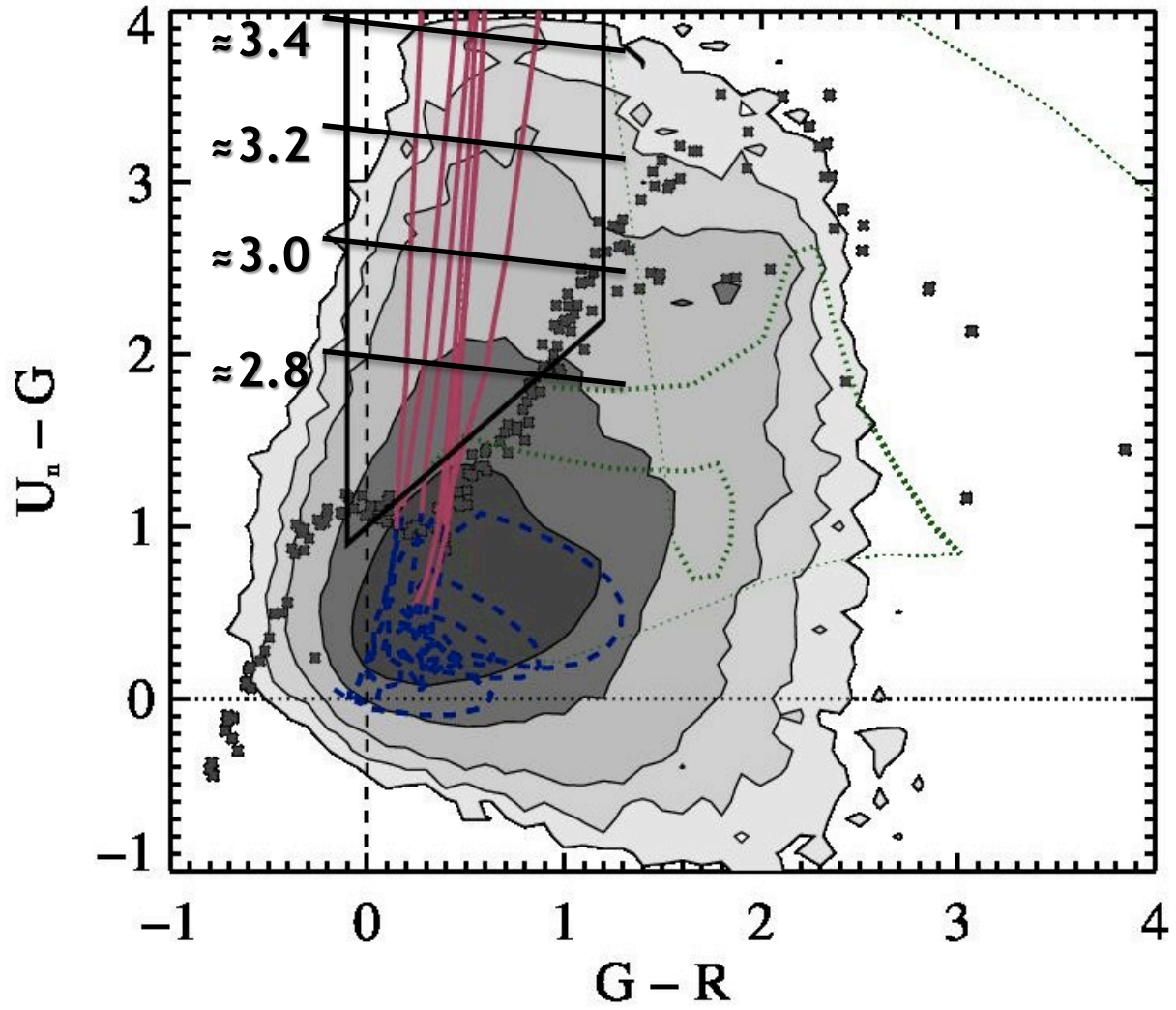
$$n_{ion} = f_{esc}\, \xi_{ion}\, \rho_{UV}$$

→ *need a full high redshift census*
→ *need to determine the escape fraction, f_{esc}*
→ ***get at ξ_{ion} from the measured continuum slope β***

- measuring f_{esc} of galaxies is challenging
  - *observationally $f_{esc} = (f_{1500Å}/f_{900Å})$*
  - *expected observed $f_{900Å} < 1 \times 10^{-30}$ ergs s^{-1} cm^{-2} Hz^{-1} ($m > \approx 26$)*
  - *optical detectors are more efficient to the red, >~3500Å*
  - *continuum absorption by the Lya forest increases with redshift*
- ***z ~ 3 - 4*** is the "sweet spot" for < 912Å measurements

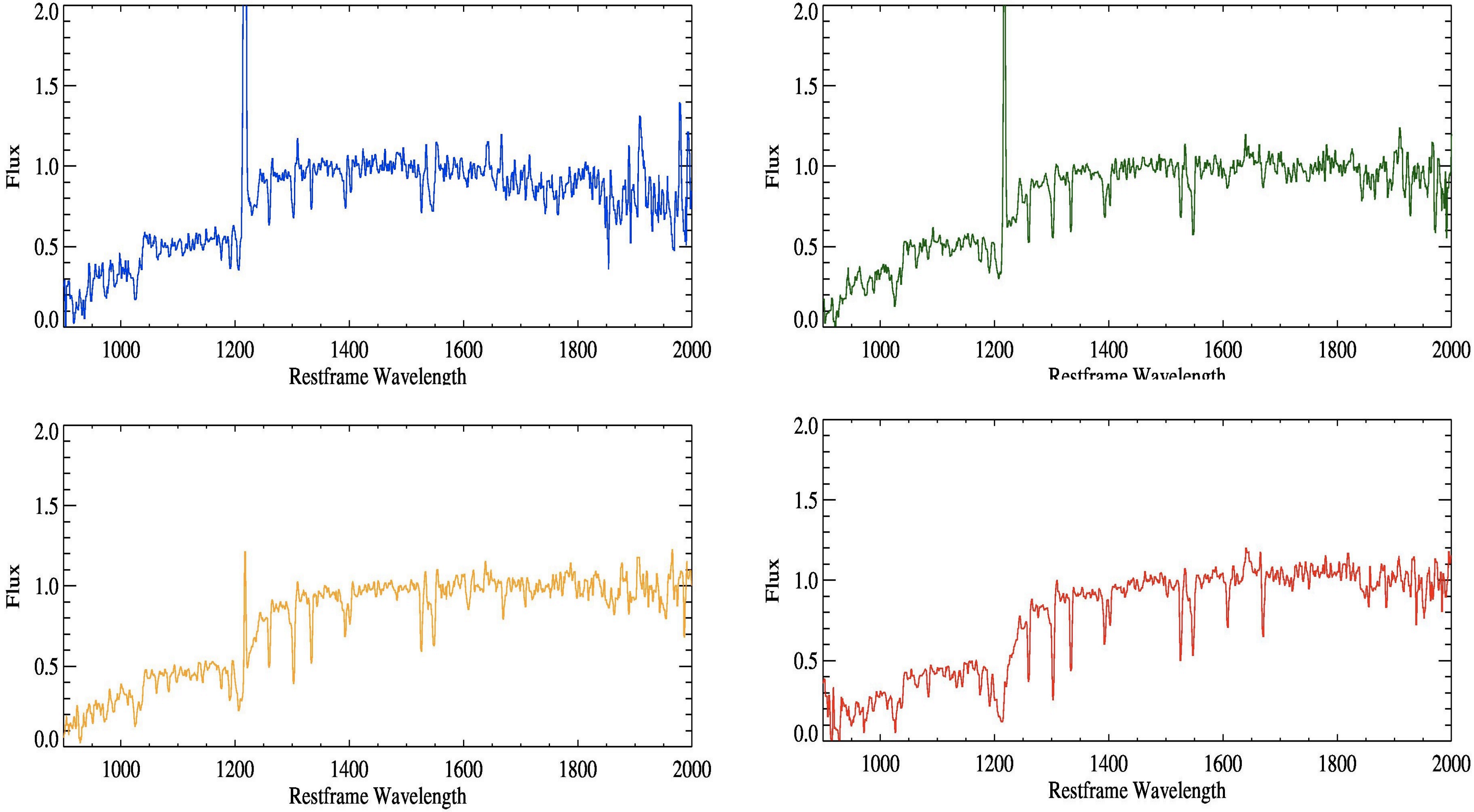
rounding up the usual suspects

U_nGR-selected $z\sim3$ LBGs *(e.g., Steidel et al. 1996, 2003)*



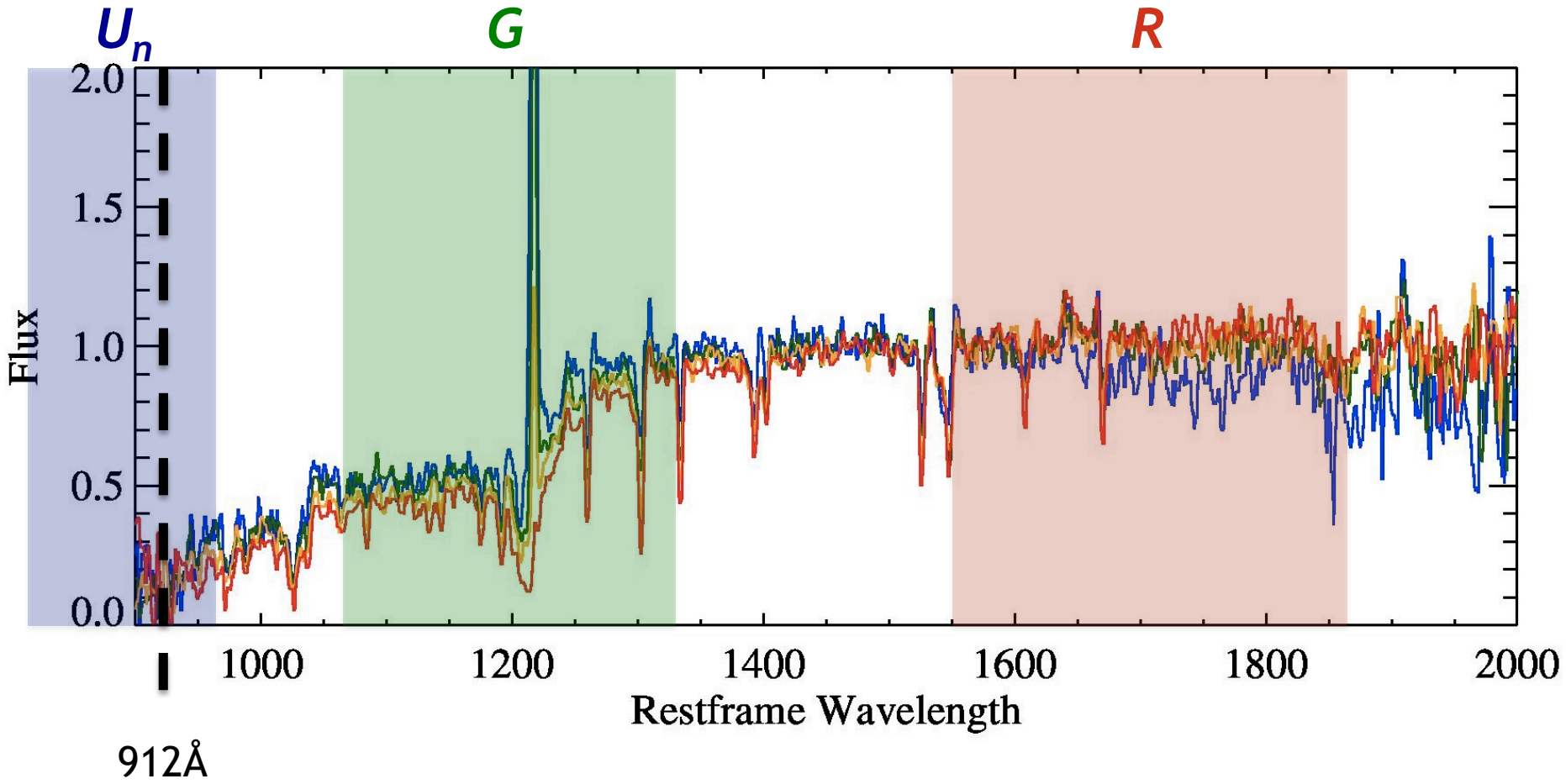
rounding up the usual suspects

U_nGR-selected *z~3* LBGs composite spectra *(Shapley et al. 2003)*



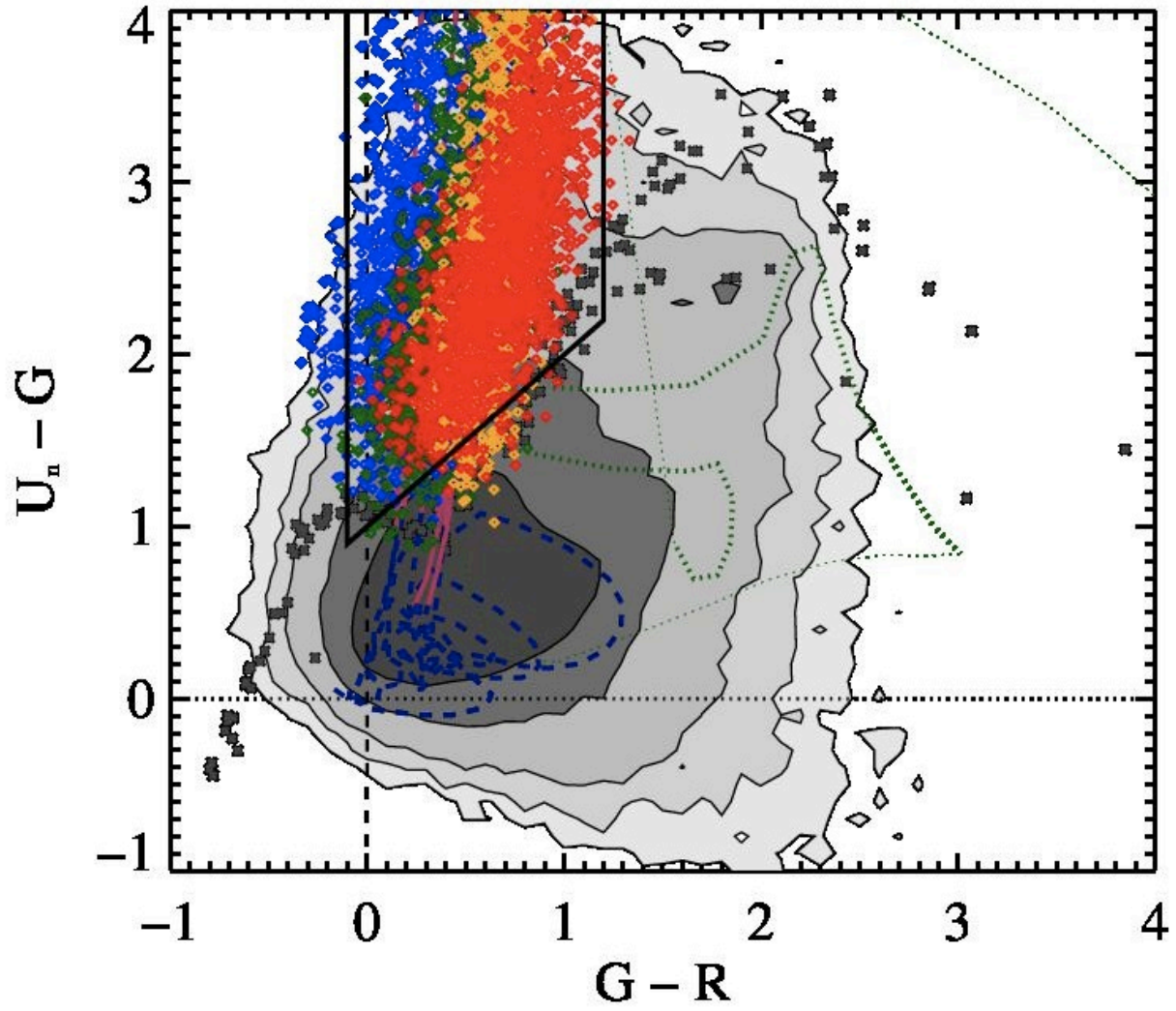
rounding up the usual suspects

U_nGR-selected $z\sim3$ LBGs composite spectra *(Shapley et al. 2003)*



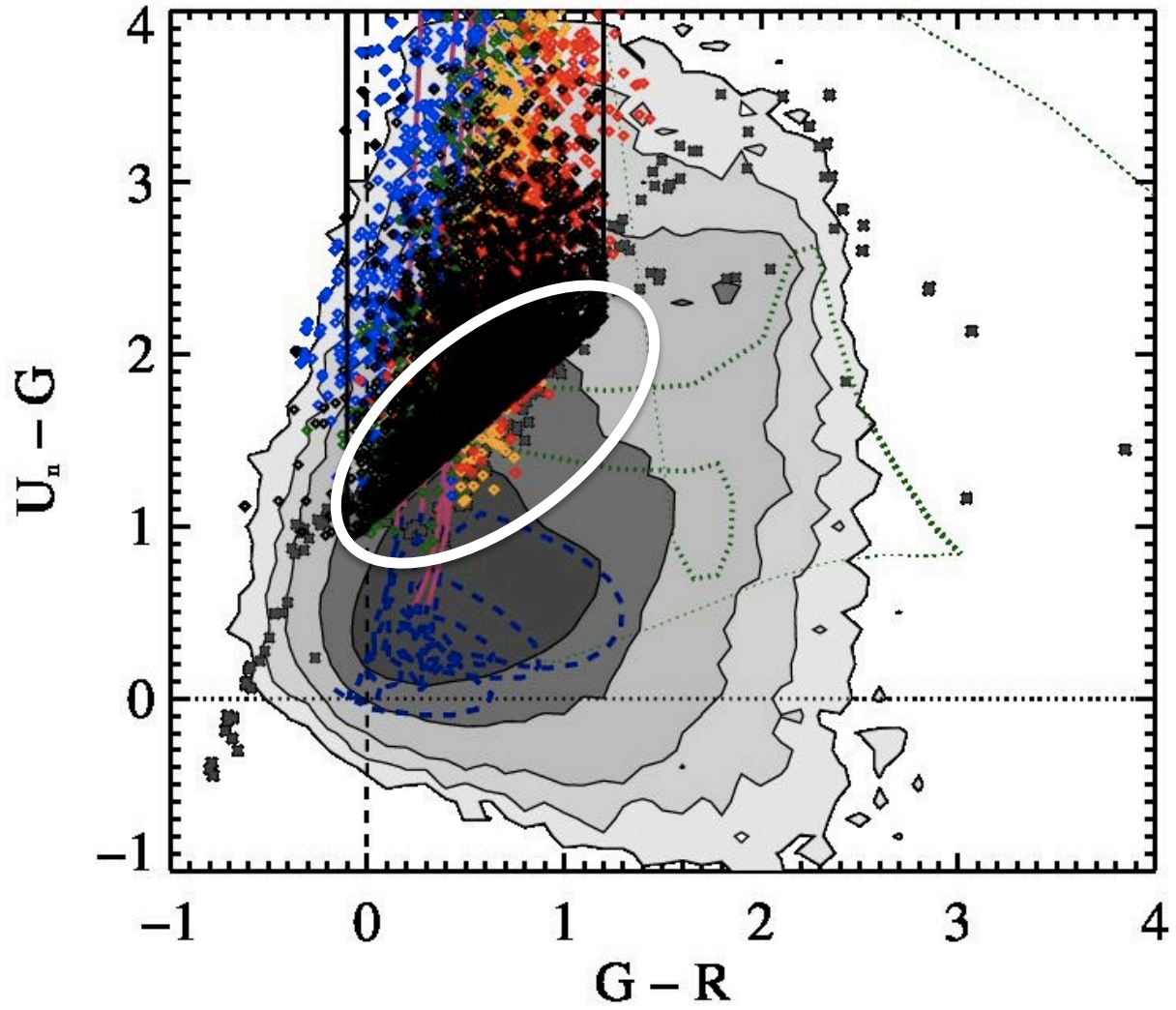
rounding up the usual suspects

U_nGR-selected $z\sim3$ LBGs *(e.g., Steidel et al. 1996, 2003)*



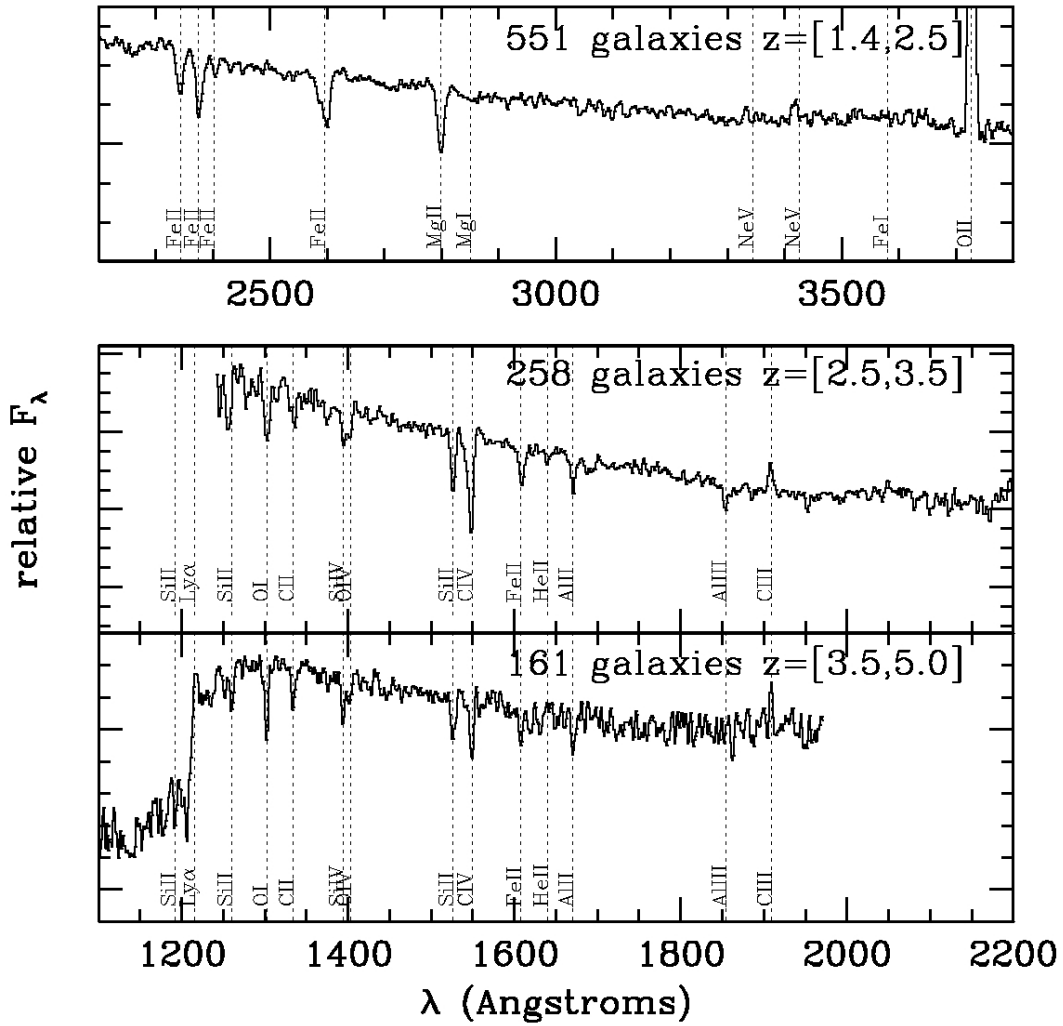
questioning the suspects

U_nGR-selected $z\sim3$ LBGs *(e.g., Steidel et al. 1996, 2003)*



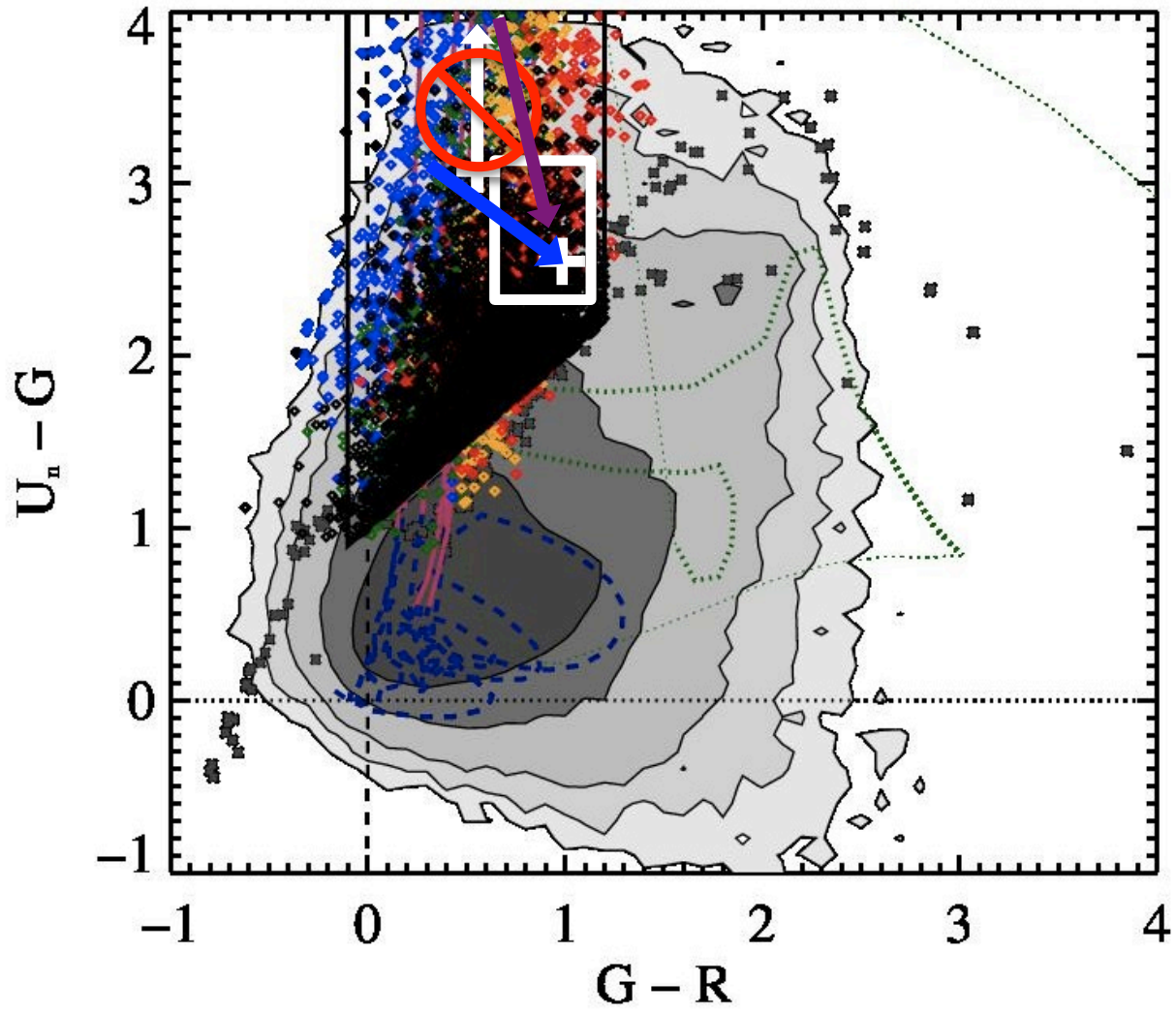
circumstantial evidence

VVDS: I_{AB} < 24 selected unbiased spectroscopic survey *(Le Fevre et al. 2005)*



circumstantial evidence

f_{esc} searches *(Steidel et al. 2001, Shapley et al. 2006)*

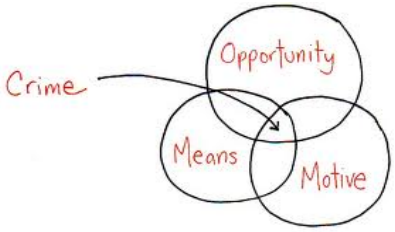


Steidel

<z>=3.4±0.14

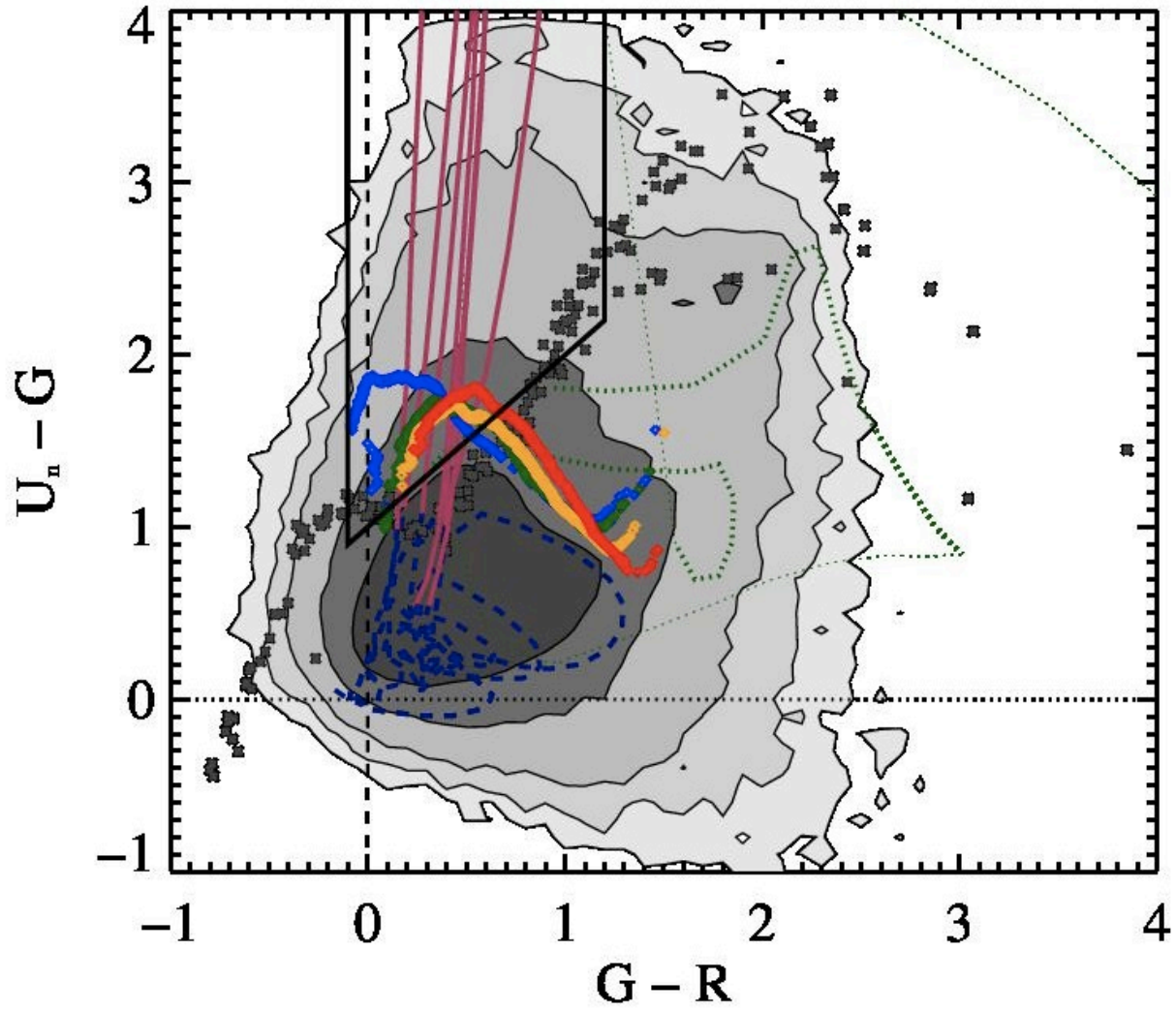
Shapley

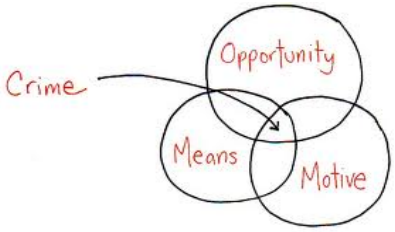
<z>=3.1



means, motive, and opportunity

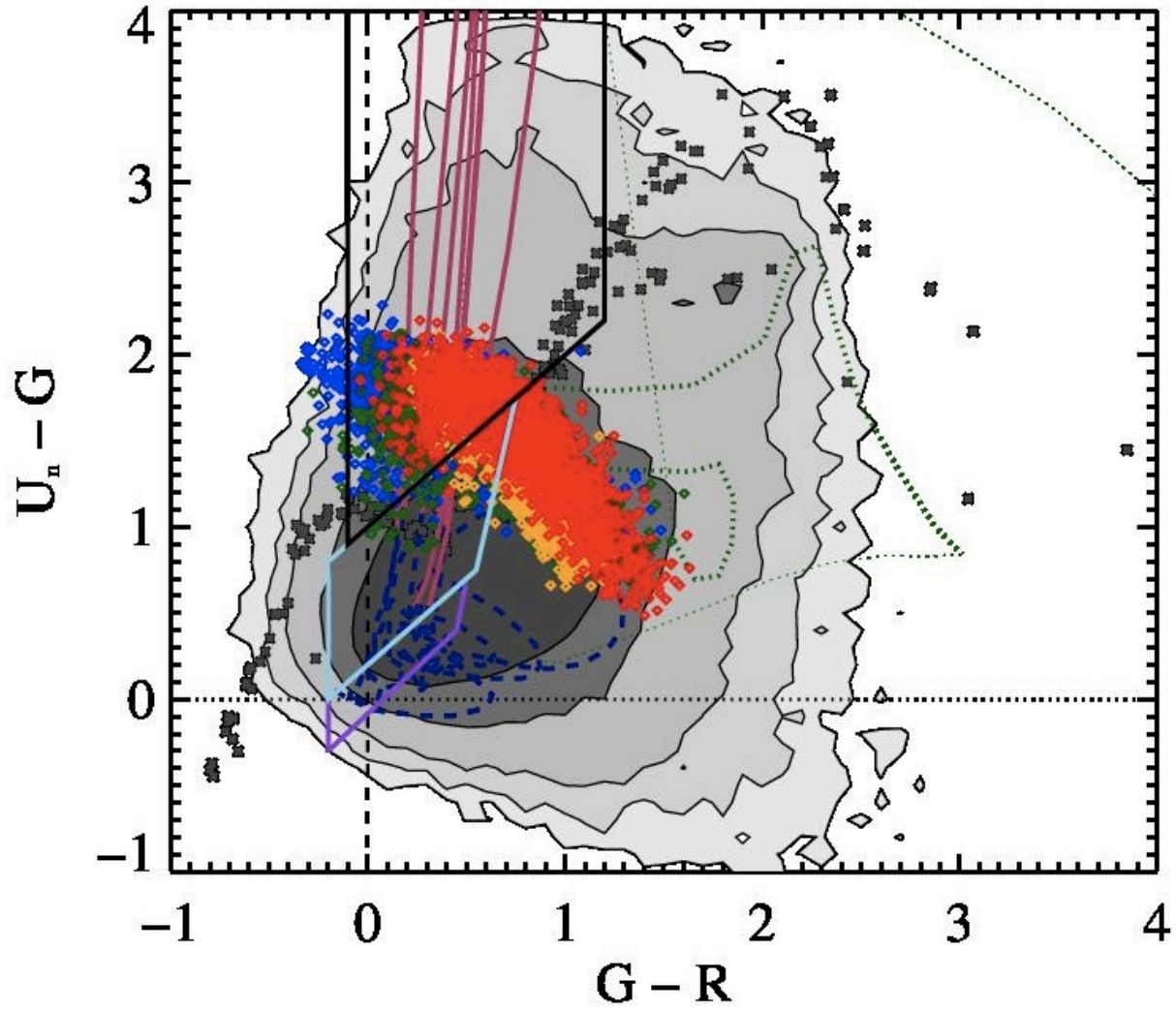
f_{esc} composite simulations *(Cooke, et al, 2013, in prep)*

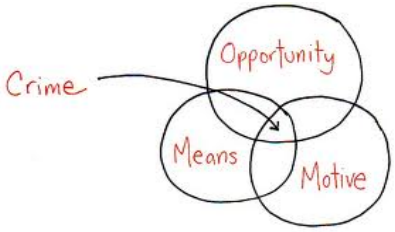




means, motive, and opportunity

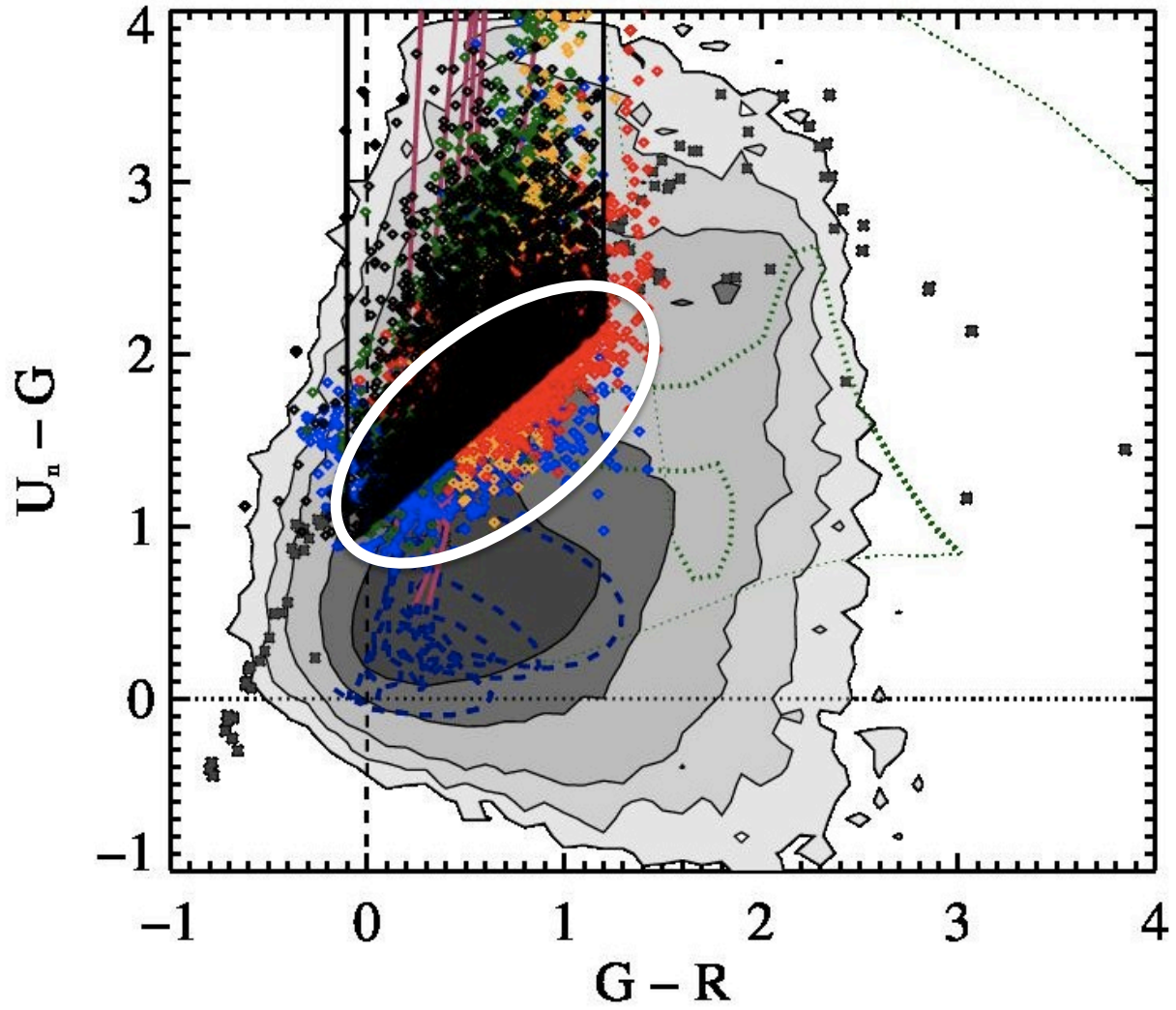
f_{esc} composite simulations *(Cooke, et al, 2013, in prep)*

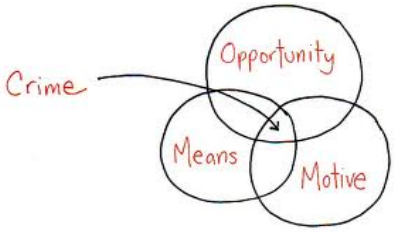




means, motive, and opportunity

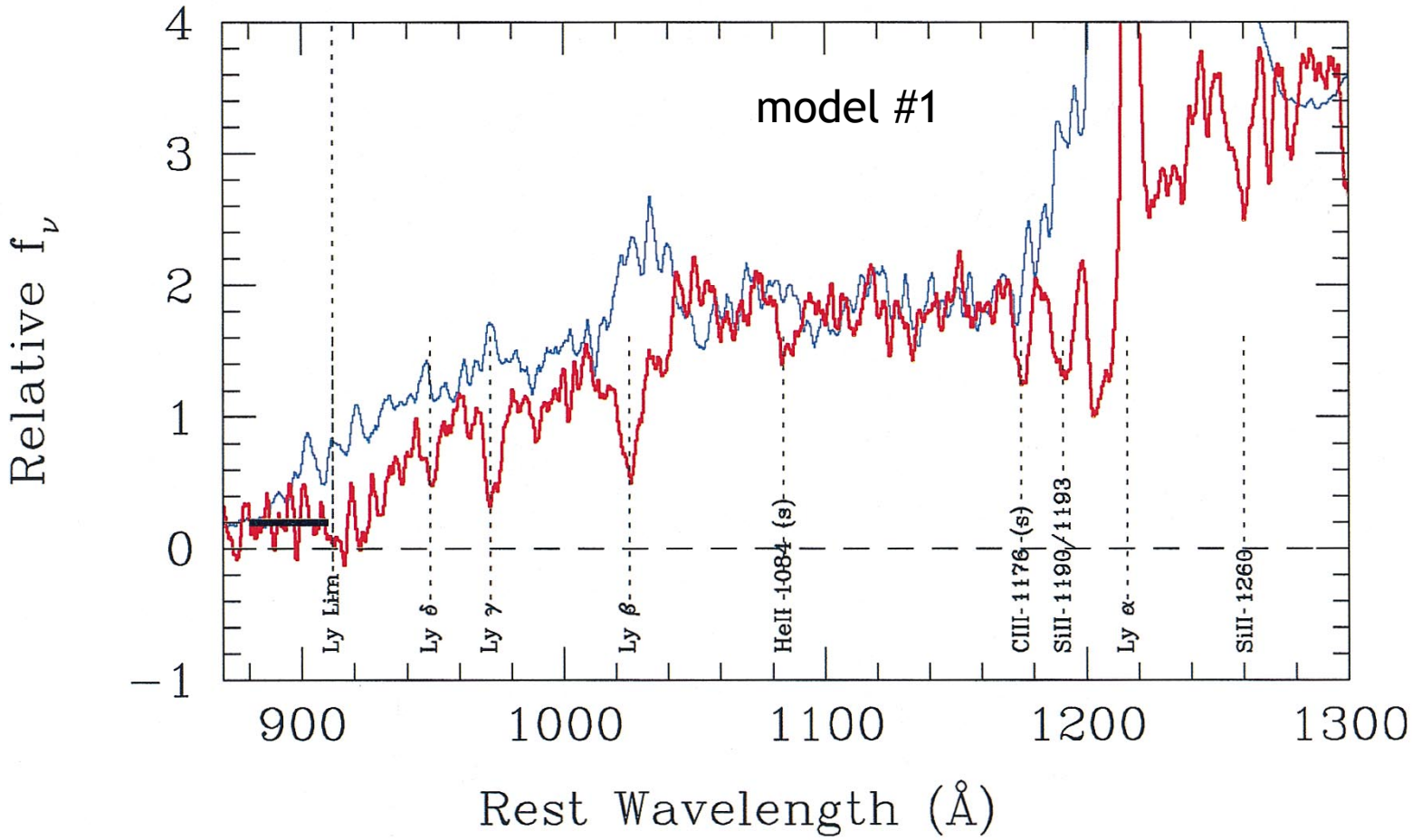
f_{esc} composite simulations *(Cooke, et al, 2013, in prep)*

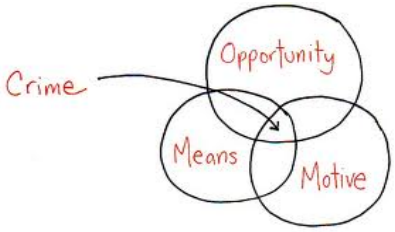




means, motive, and opportunity

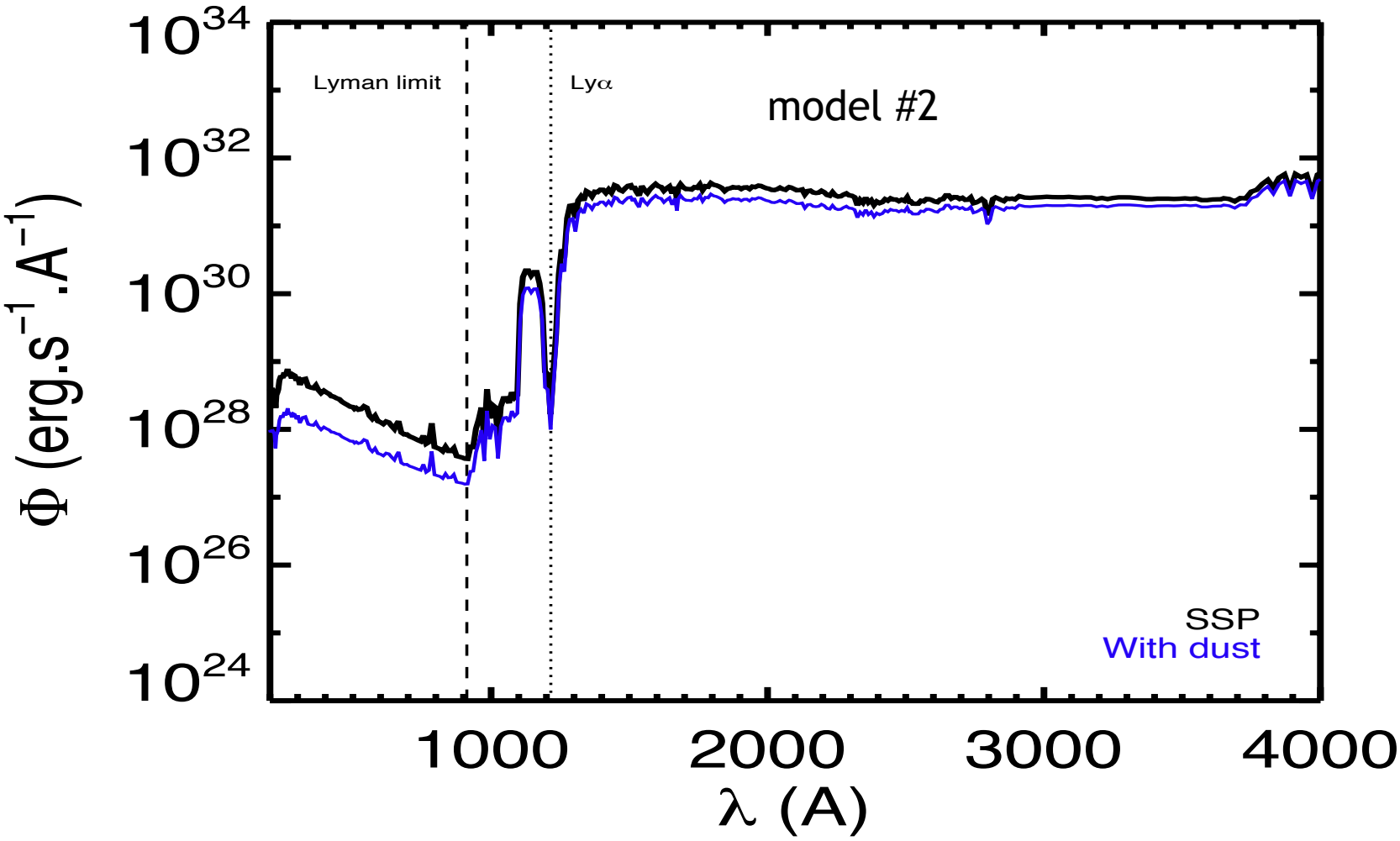
f_{esc} definitions *(Steidel et al. 2001, Shapley et al. 2006)*





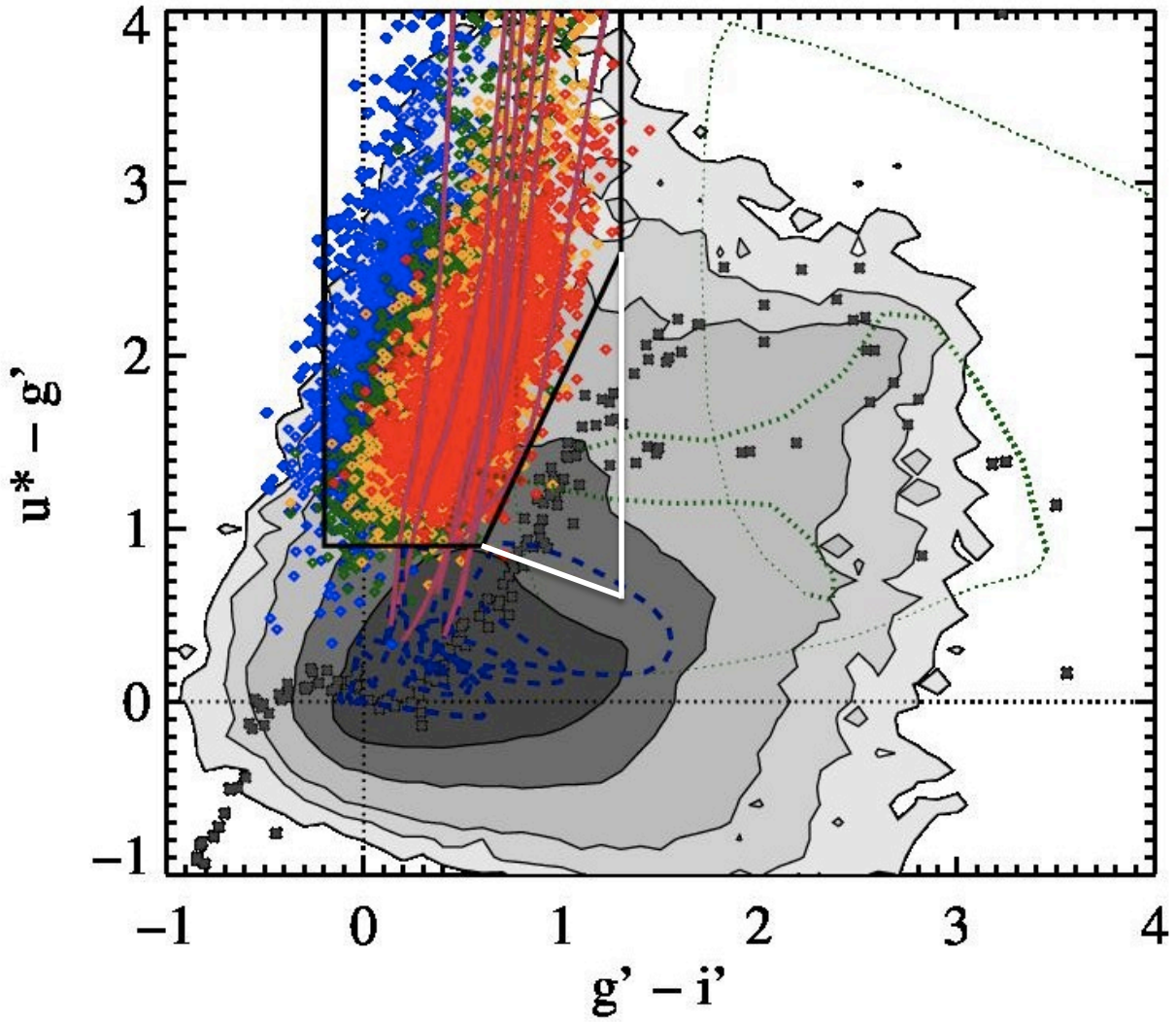
means, motive, and opportunity

f_{esc} definitions



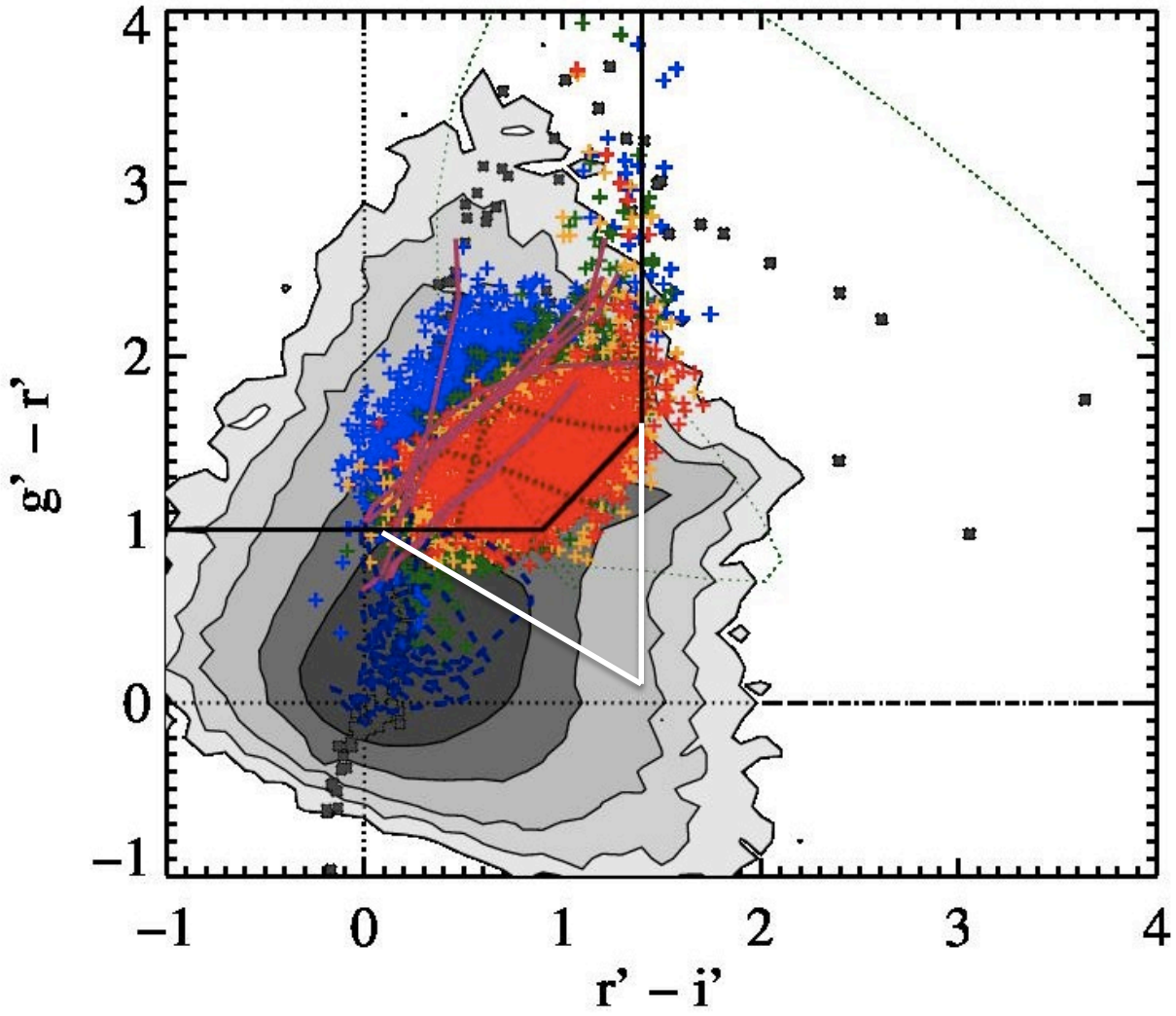
catching the real culprit

$z\sim3$ f_{esc} search region



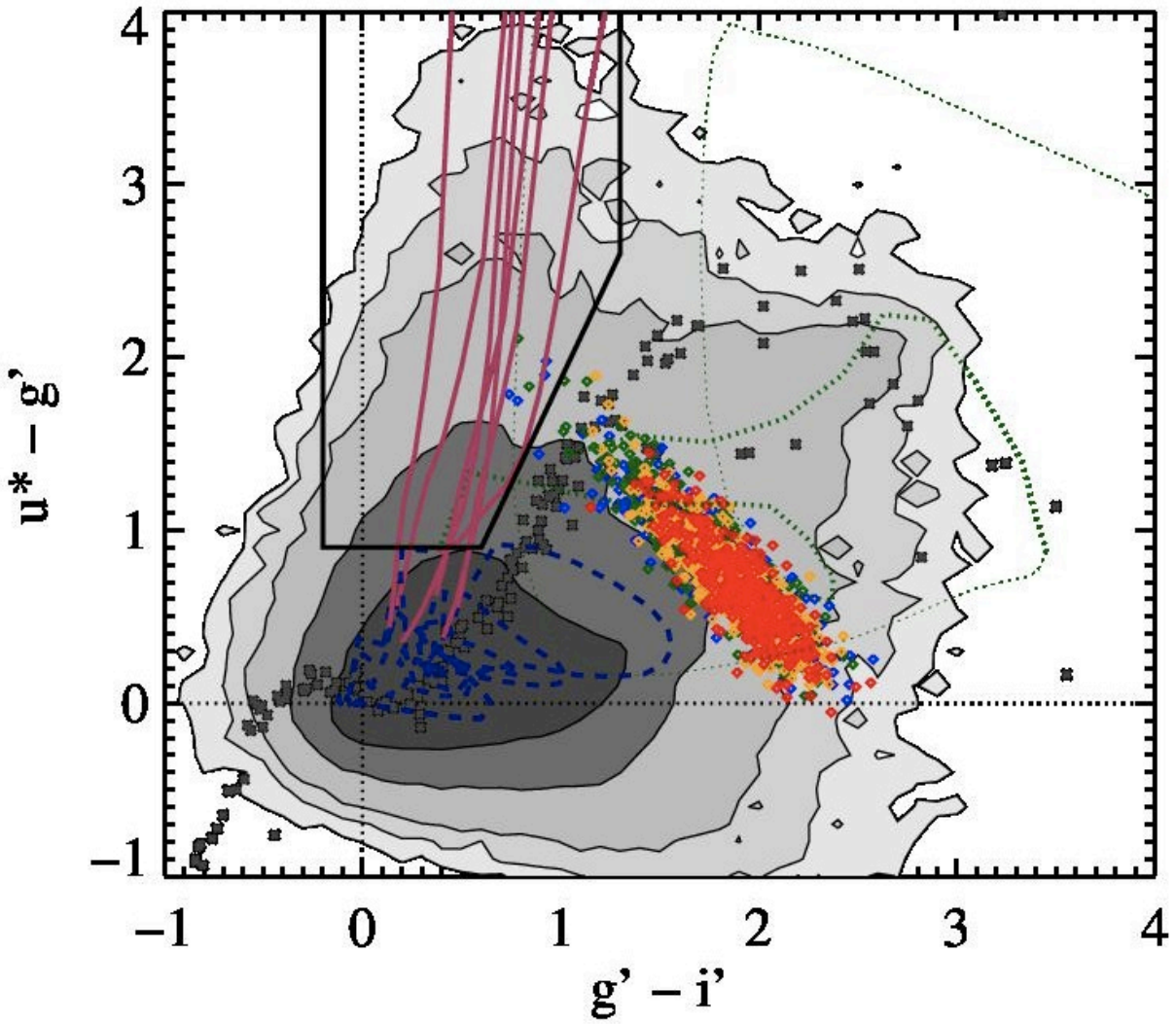
catching the real culprit

$z\sim4$ f_{esc} search region



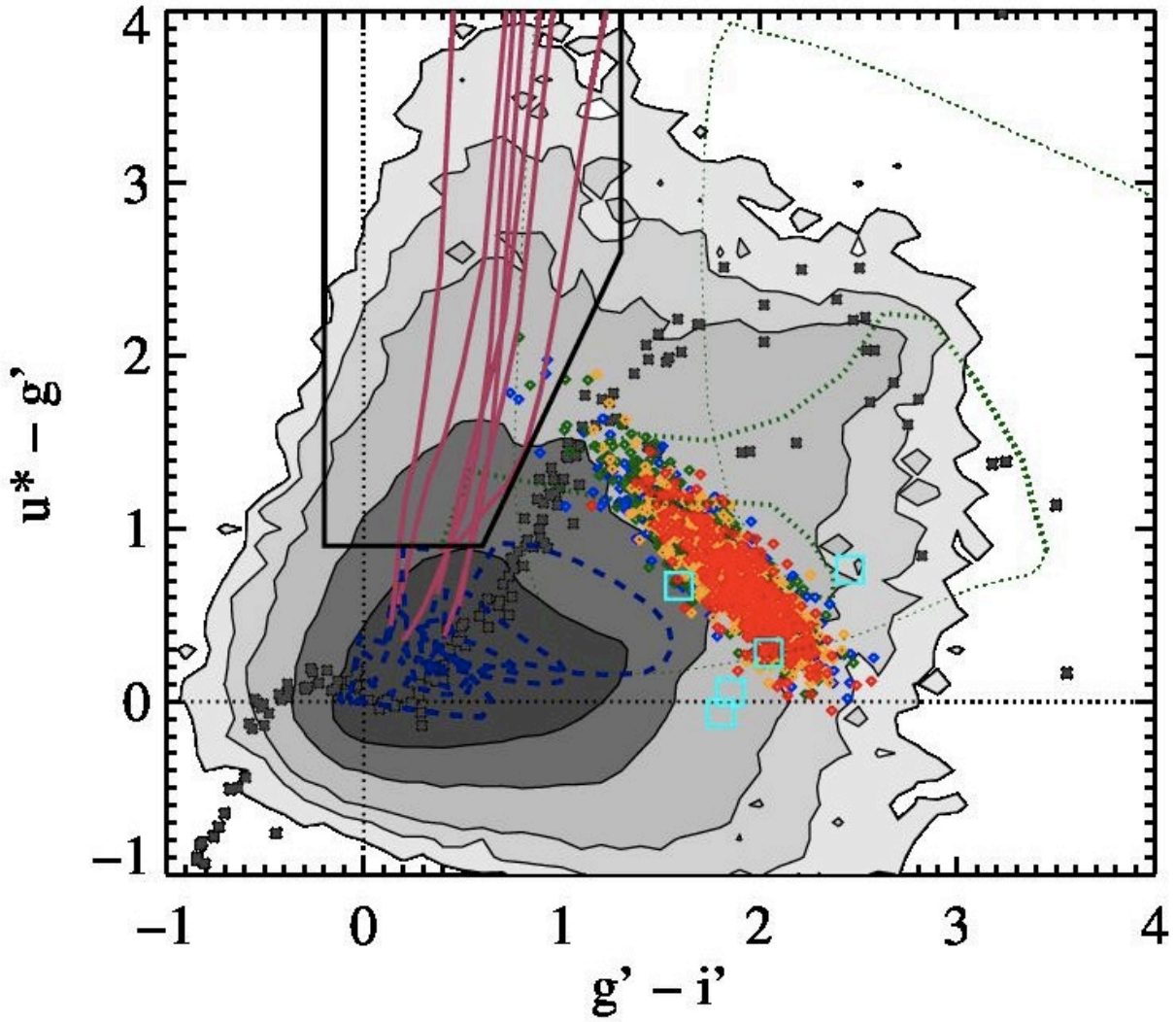
catching the real culprit

z~4 f_{esc} in the (z~3) u*-g' vs. g'-i' color-color plane



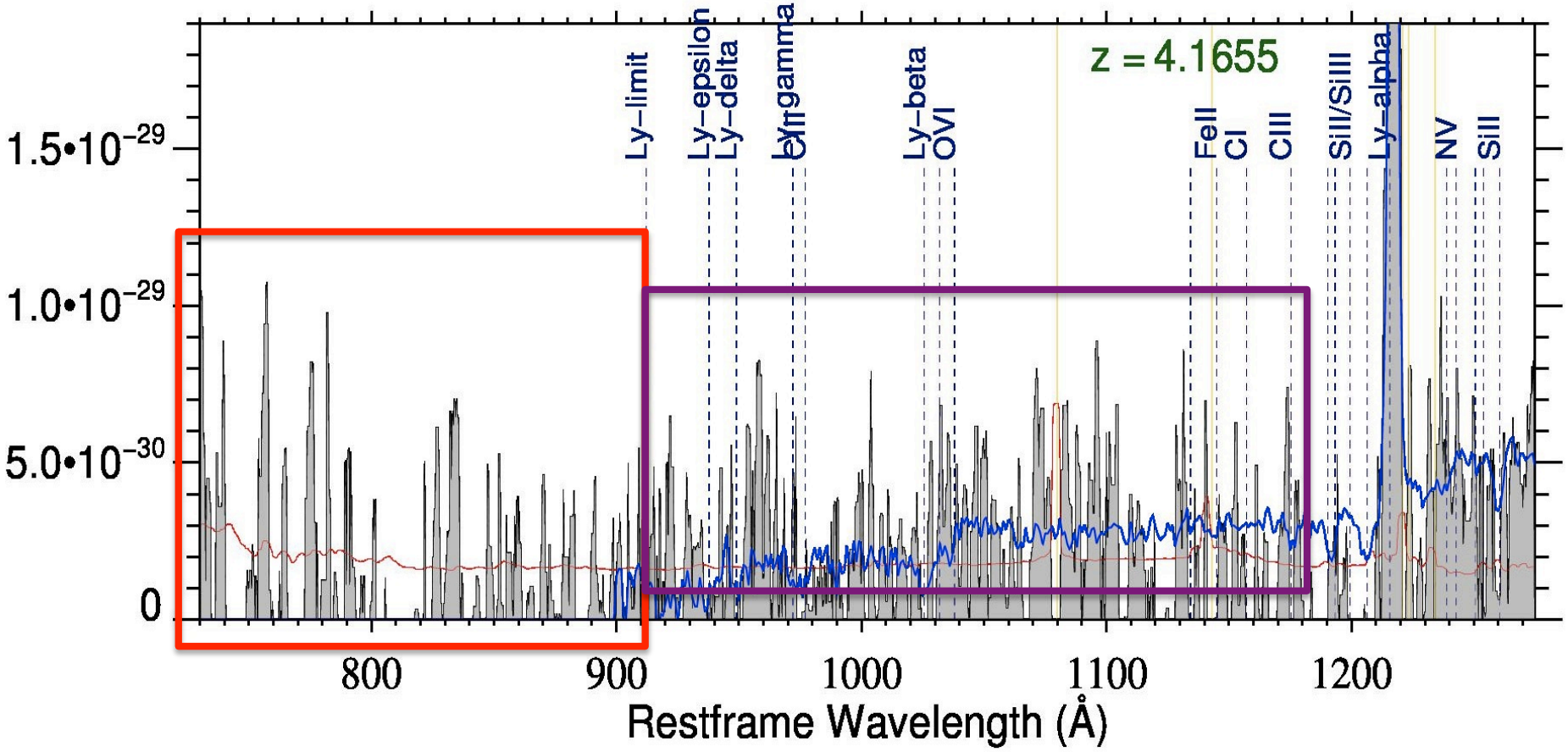
standing trial

z~4 f_{esc} candidate population confirmation



standing trial

$z\sim4$ f_{esc} candidate population confirmation



the verdict

Result 1.) The distribution of conventionally-selected Lyman break galaxies indicates that a significant fraction of high-*z* galaxies are missed

Result 2.) By definition, the Lyman break technique selects ***against*** galaxies with high escape fractions *(u-band bright)*

Result 3) A significant population of galaxies in the "missed" region outside conventional color criteria has been spectroscopically identified

Result 4) The ***only*** explanation for the galaxies found outside the criteria is stronger 600-1050A flux, hence Lyman continuum photons

Result 5) Search for these high-f_{esc} galaxies is crucial for the full census of high-*z* galaxies and the key contributors to reionization