# Nearby Clumpy, Gas Rich, Star Forming Galaxies:
# Local Analogs of High Redshift Clumpy Galaxies


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**IGM@50 • June 9, 2015**

# Collaborators

- **D. J. Pisano** (West Virginia University)
- **Mordecai-Mark Mac Low** (American Museum of Natural History)
- **Kathryn Kreckel** (Max-Planck-Institut für Astronomie)
- **Katie Rabidoux** (West Virginia University)
- **Rafael Guzmán** (University of Florida)

# Local Luminous Compact Blue Galaxies

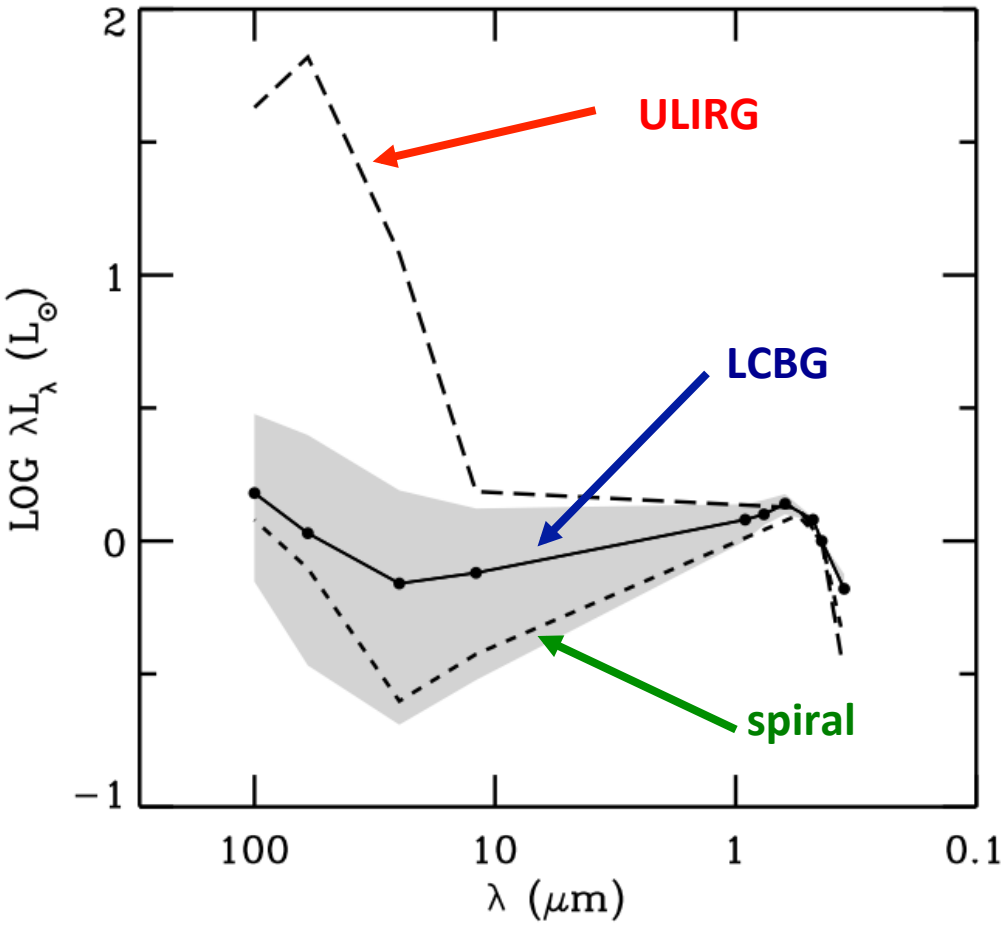
$M_B \leq -18.5$ $\quad$ SBe ≤ 21 B-mag arsec$^{-2}$ $\quad$ B-V ≤ 0.6

Werk et al. 2004

~10 kpc

SDSS DR7

# LCBGs are not local ULIRGs




Garland et al. 2004

# LCBGs are not blue compact dwarf galaxies

# Questions:

- ❑ Cause of enhanced star formation?

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  external? (galaxy-galaxy or galaxy-cluster)

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  **external?** (galaxy-galaxy or galaxy-cluster)

  **internal?** (high gas fraction due to accretion)

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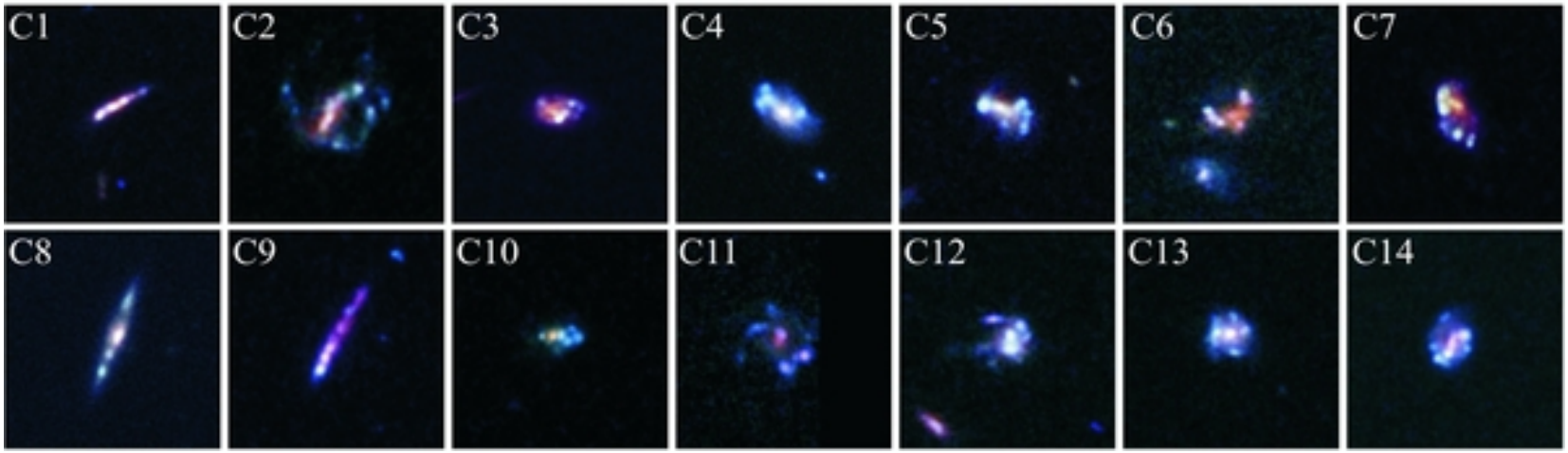
  **e.g. SFGs at z ~ 1–3 studied by Tacconi et al. 2013, Daddi et al. 2010, Förster Schreiber et al. 2009 etc.**




Bournaud et al. 2012

# Sample

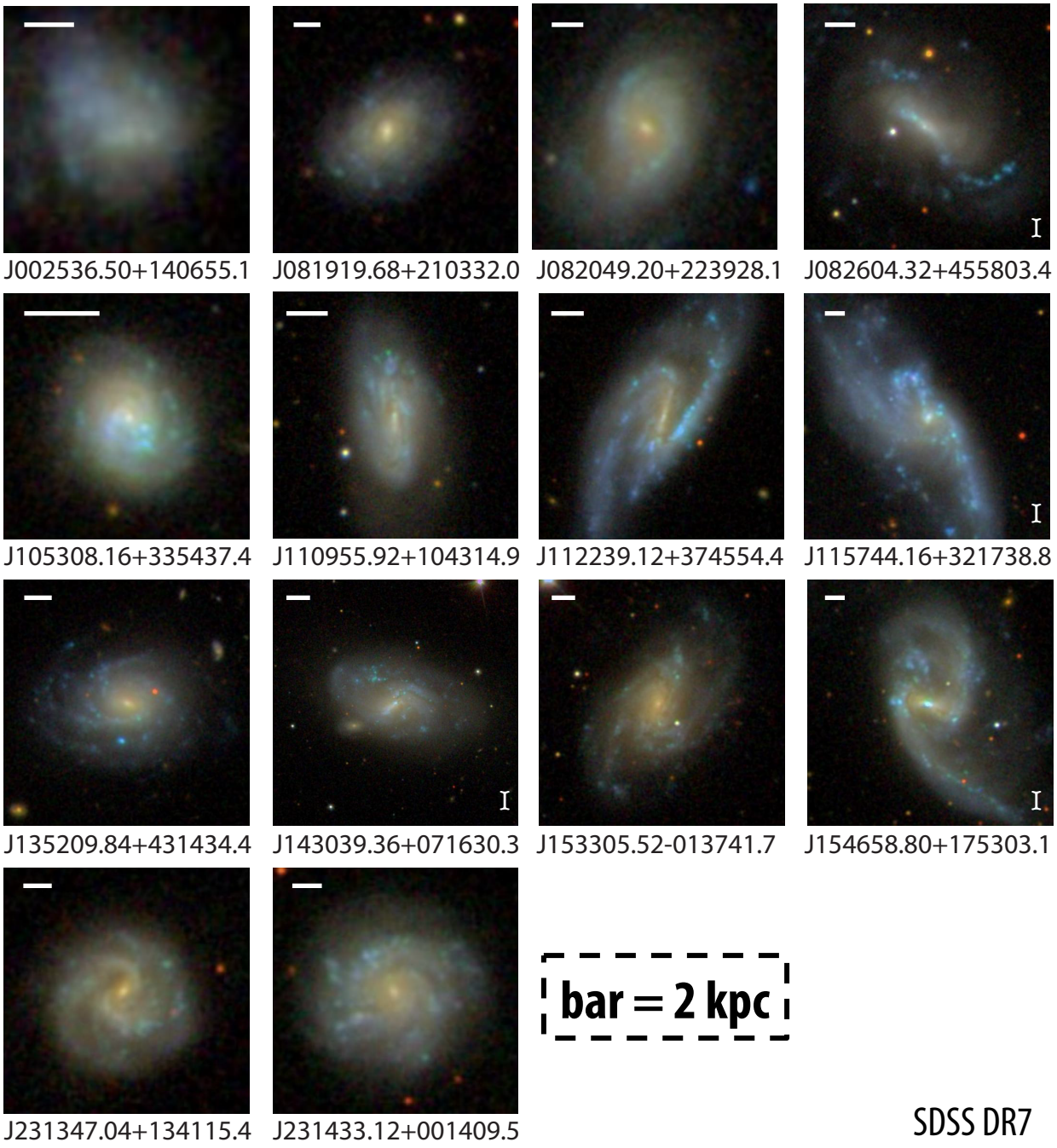

DR7

**29 LCBGs with**

- ❑ **D < 76 Mpc.**
- ❑ **Hα SFR and $M_\star$ available.**
- ❑ **HI observations available (acquired or via archives).**

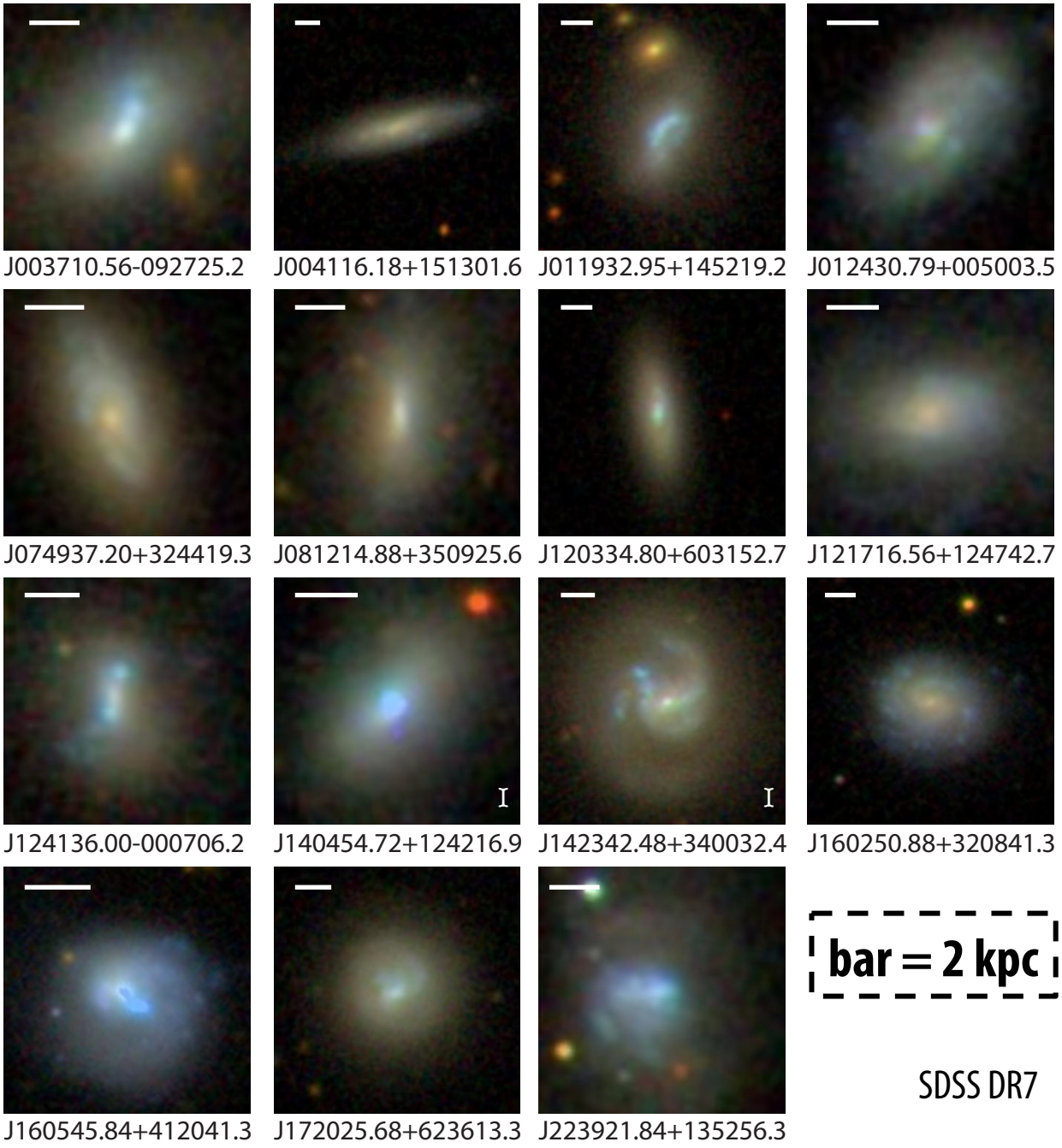
MPA-JHU SDSS DR7 Value Added Catalog

# CLUMPY
## (~ 1 kpc)




SDSS DR7

# NOT CLUMPY


J003710.56-092725.2
J004116.18+151301.6
J011932.95+145219.2
J012430.79+005003.5
J074937.20+324419.3
J081214.88+350925.6
J120334.80+603152.7
J121716.56+124742.7
J124136.00-000706.2
J140454.72+124216.9
J142342.48+340032.4
J160250.88+320841.3
J160545.84+412041.3
J172025.68+623613.3
J223921.84+135256.3
bar = 2 kpc
SDSS DR7

# Properties

| Property | Mean | Range | high-z SFGs |
|---|---|---|---|
| **morphology** | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

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e.g. Tacconi et al. 2013, Daddi et al. 2010, Förster Schreiber et al. 2009, Elmegreen et al. 2007 ...

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$$f_{HI} = M_{HI} / (M_{HI} + M_\star)$$

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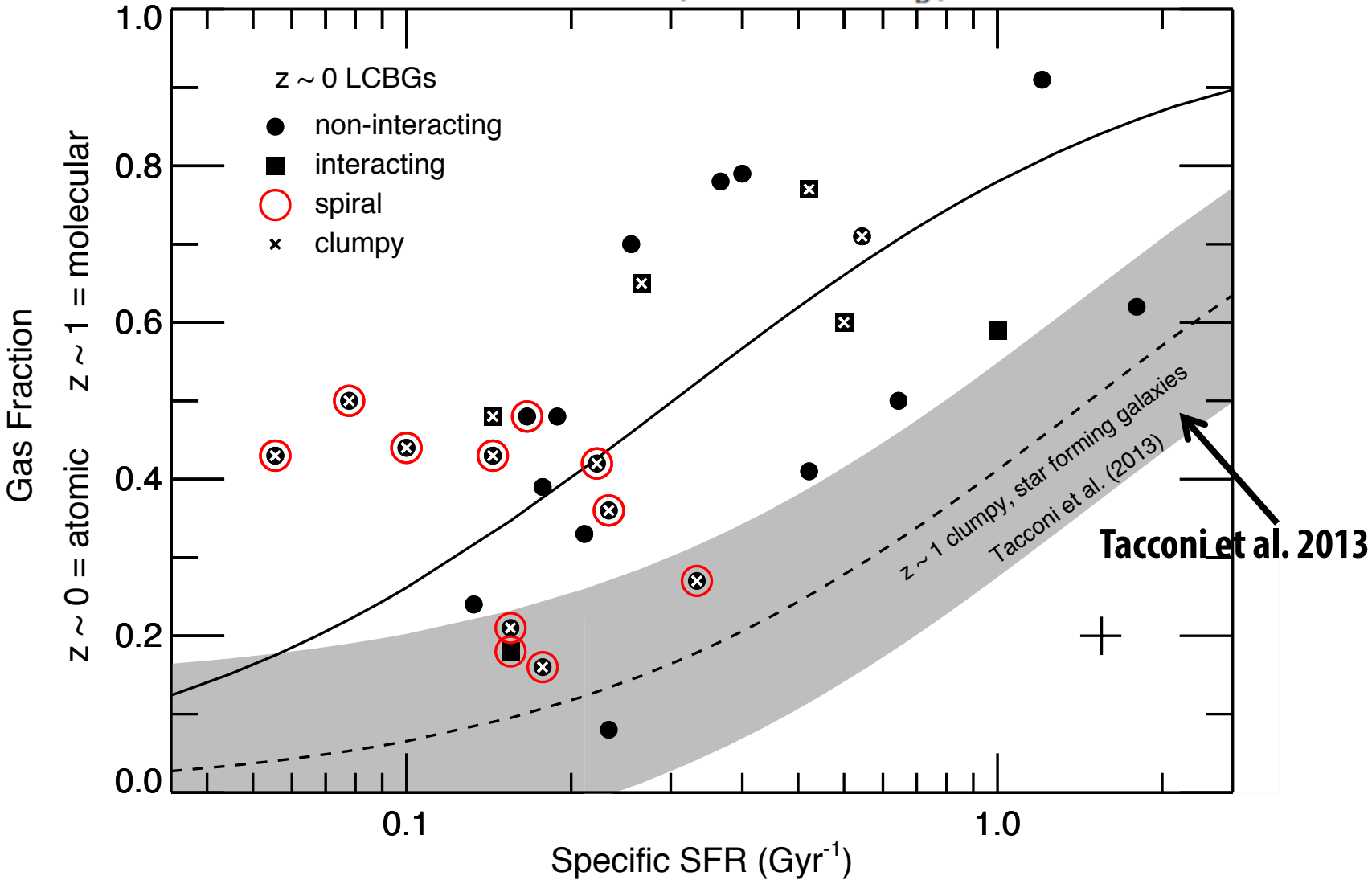
$f_{HI}\ \alpha$ sSFR

$$f_{HI} = \frac{1}{1 + (sSFR \times \tau_g)^{-1}}$$



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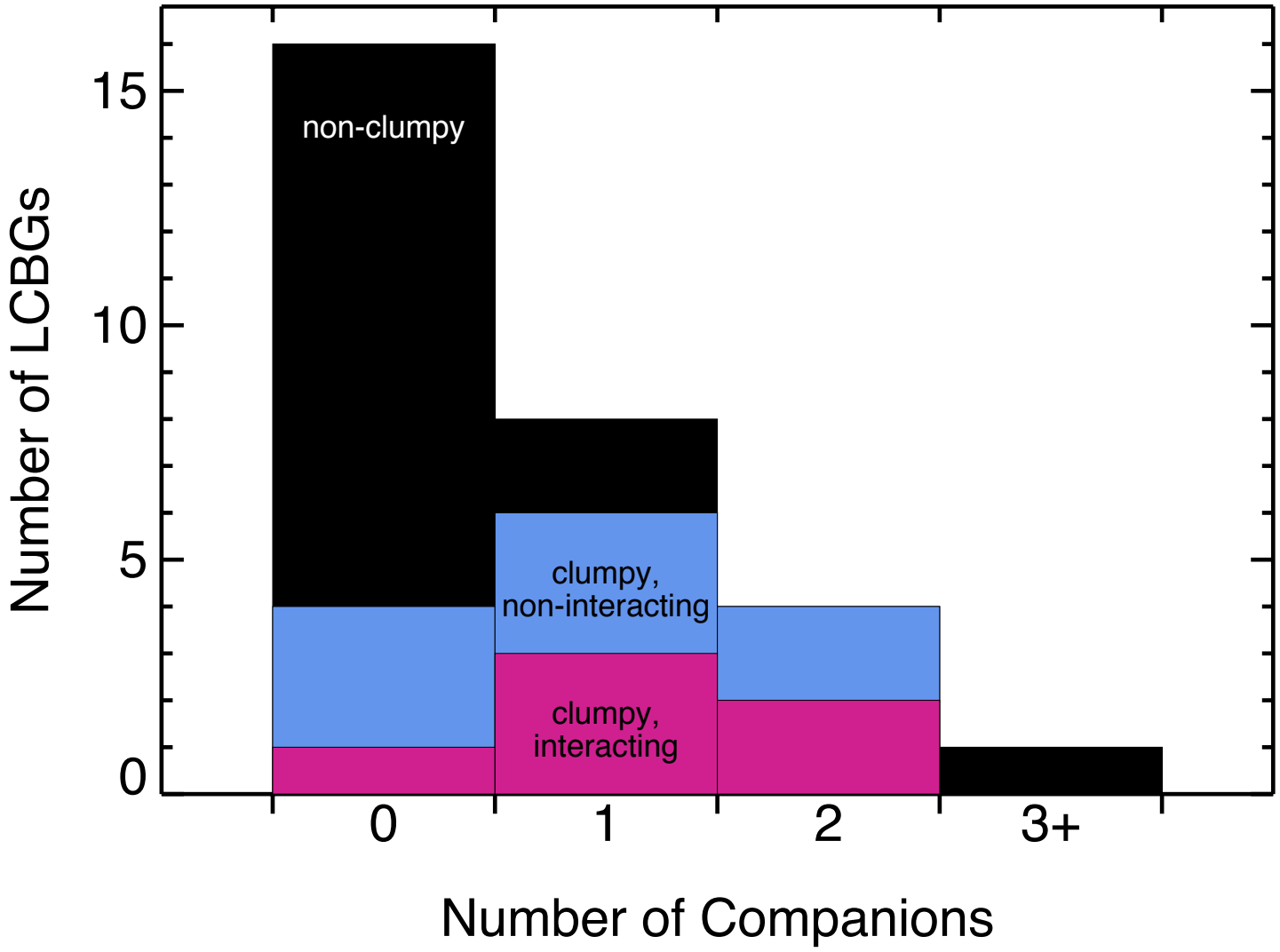
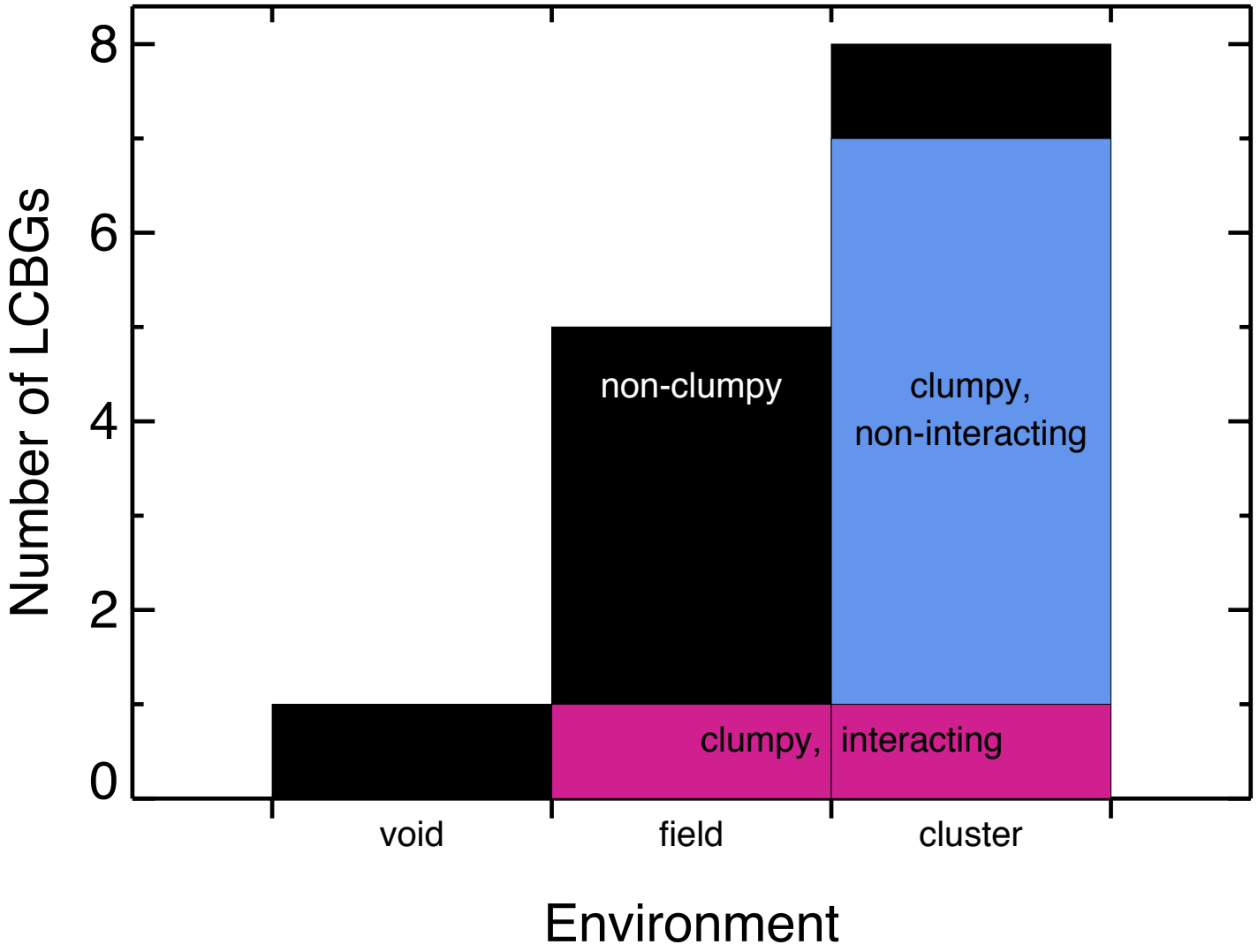
**Local LCBGs appear similar to high redshift SFGs.**

# Local Environment




NED

# Global Environment



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|---|---|---|
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| | –redder<br>–larger Re(r)<br>–higher $M_{\star}$<br>–lower gas fractions<br>–lower sSFRs | |

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| | -violent gravitational instabilities fragment disks | -could be cold accretion |
| | -not cold flows<br>-accrete gas from companions or ICM enriched by stripped satellites | -did clumps form?<br>-are clumps undetected?<br>-did clumps migrate? |

?

# Local Analogs to High-z SFGs

**Local and global environments affect the method of building large gas fractions and produce clear differences in characteristics of LCBGs.**

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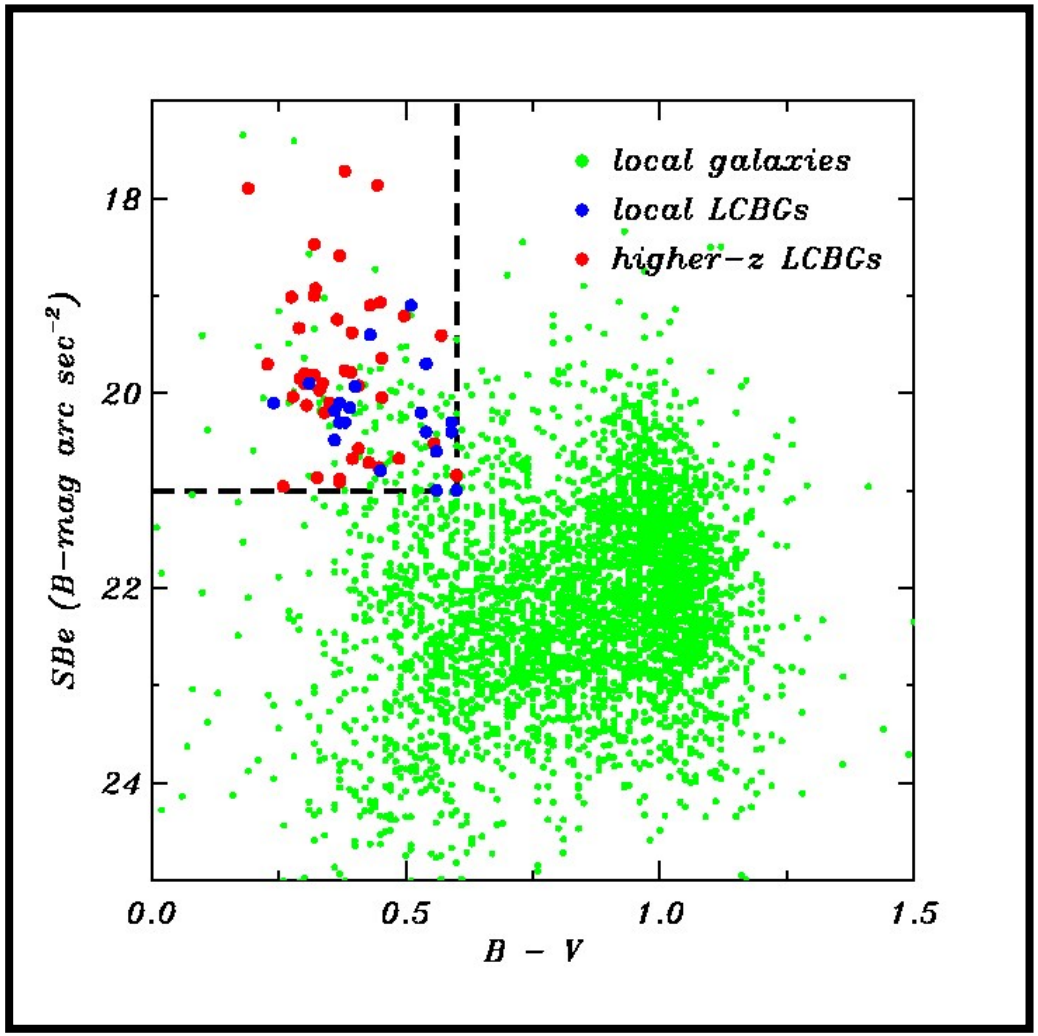
## Accepted by ApJ

# LCBGs

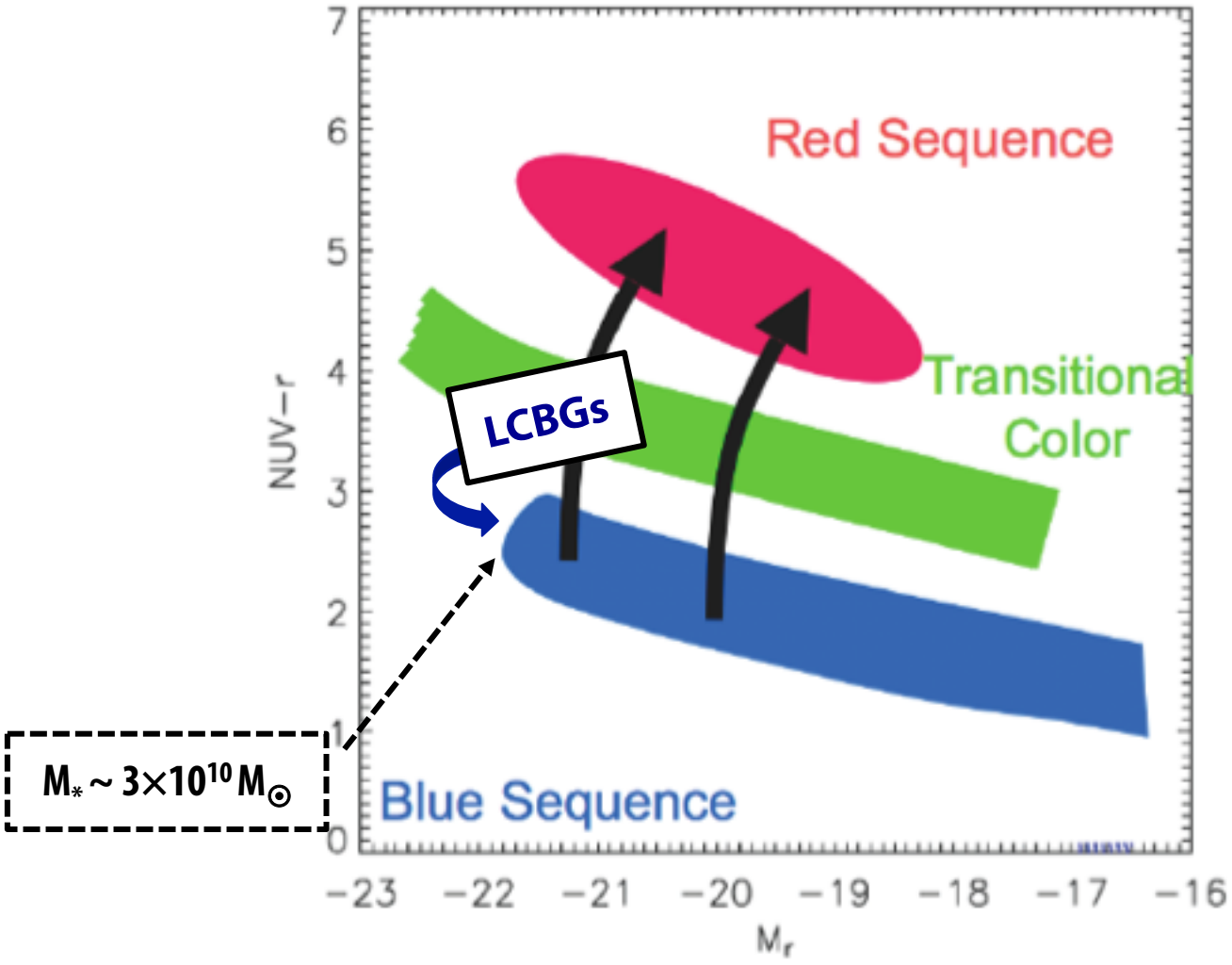



Garland et al. 2004

**Cuts serve to define similar objects over a range of redshifts.**

- **D ≤ 70 Mpc**
- **0.4 ≤ z ≤ 1**

# LCBGs lie at the high-mass end of the blue sequence




e.g. Blanton et al. 2003
graphic: Thiago S. Gonçalves