Dark Matter

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T R 11:30-12:45pm
Sears 552

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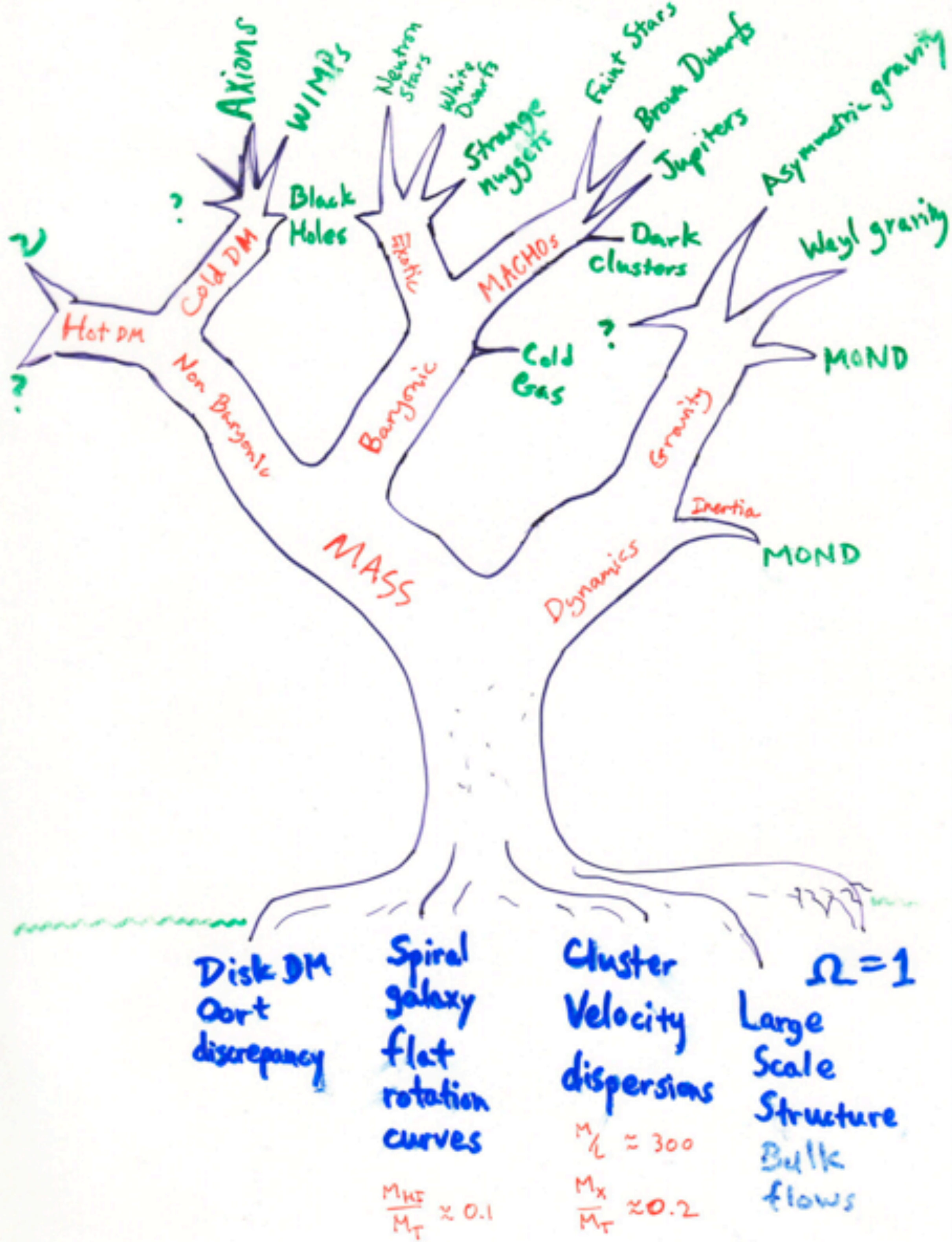
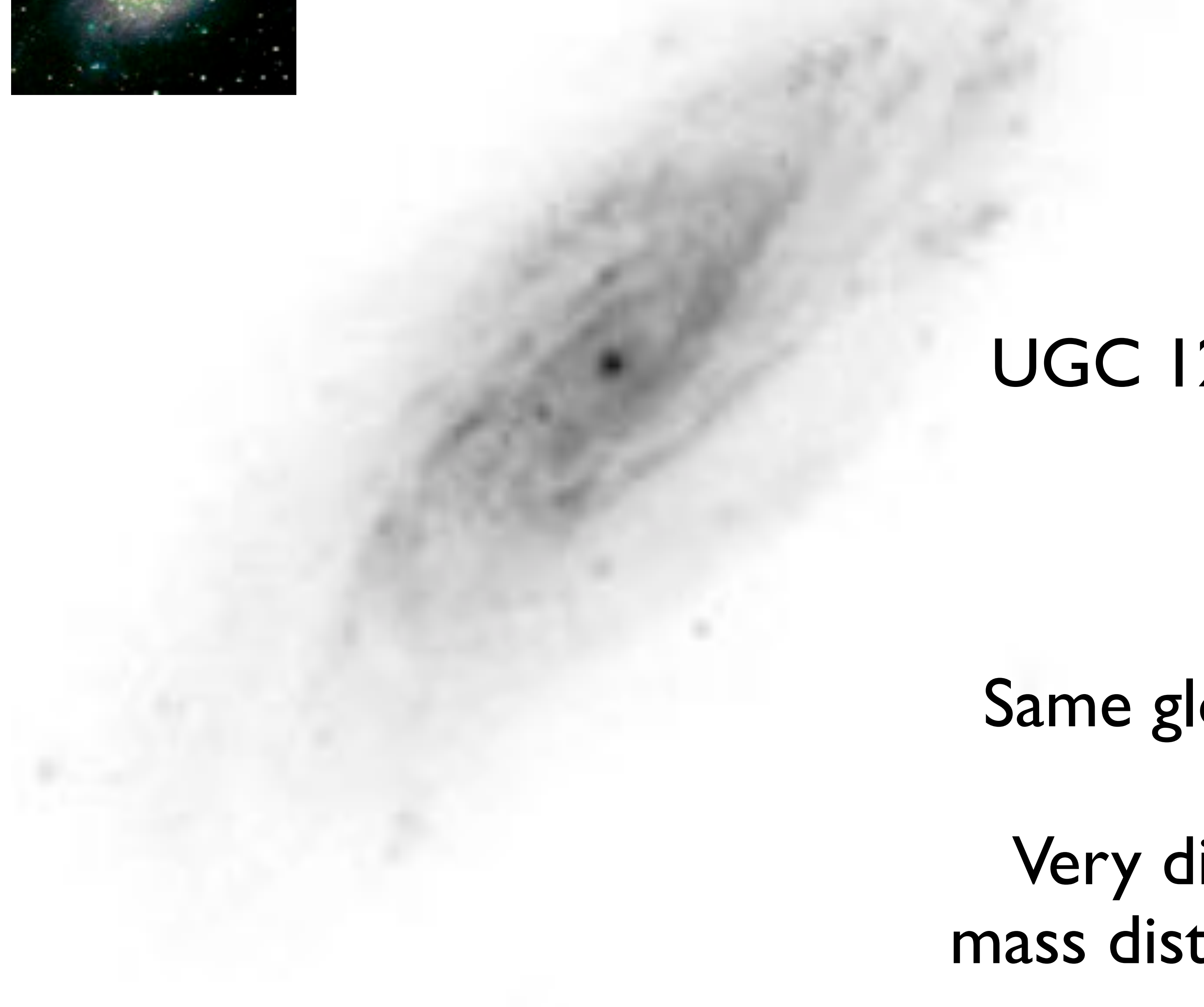


NGC 2403

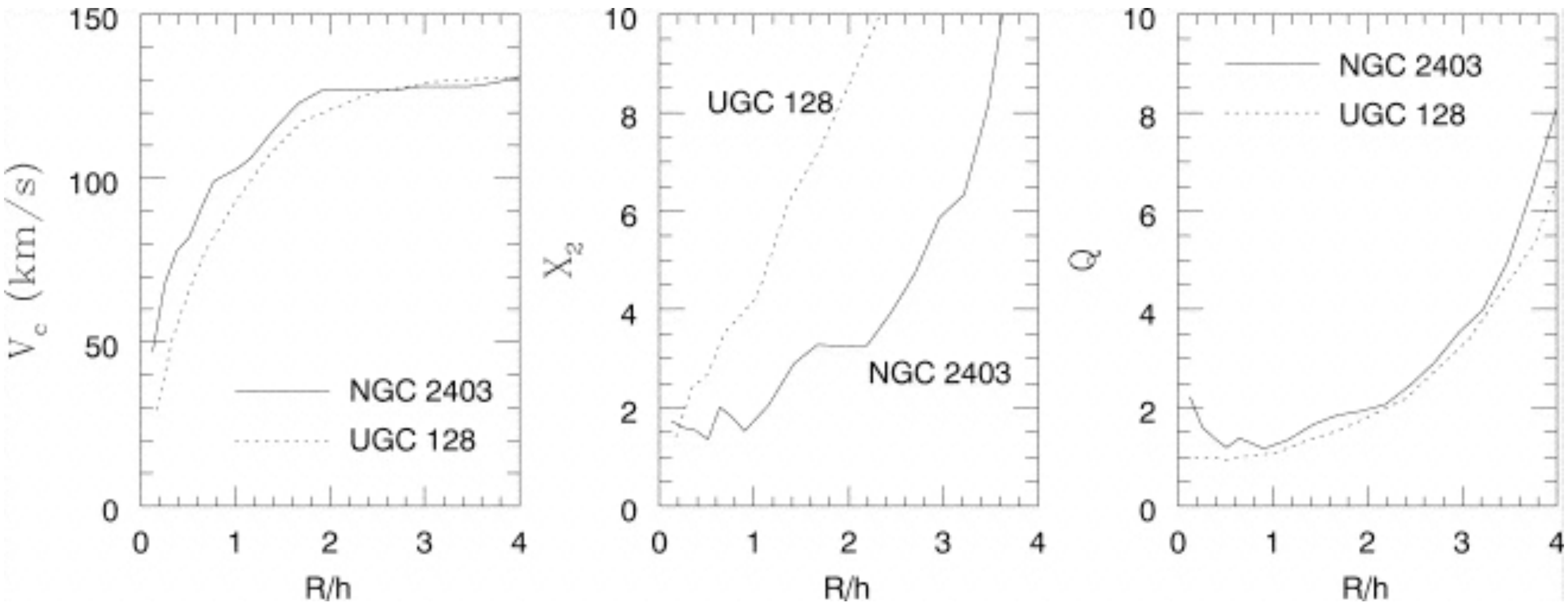


UGC 128

Same global L,V

Very different
mass distributions

NGC 2403: high surface brightness
UGC 128: low surface brightness

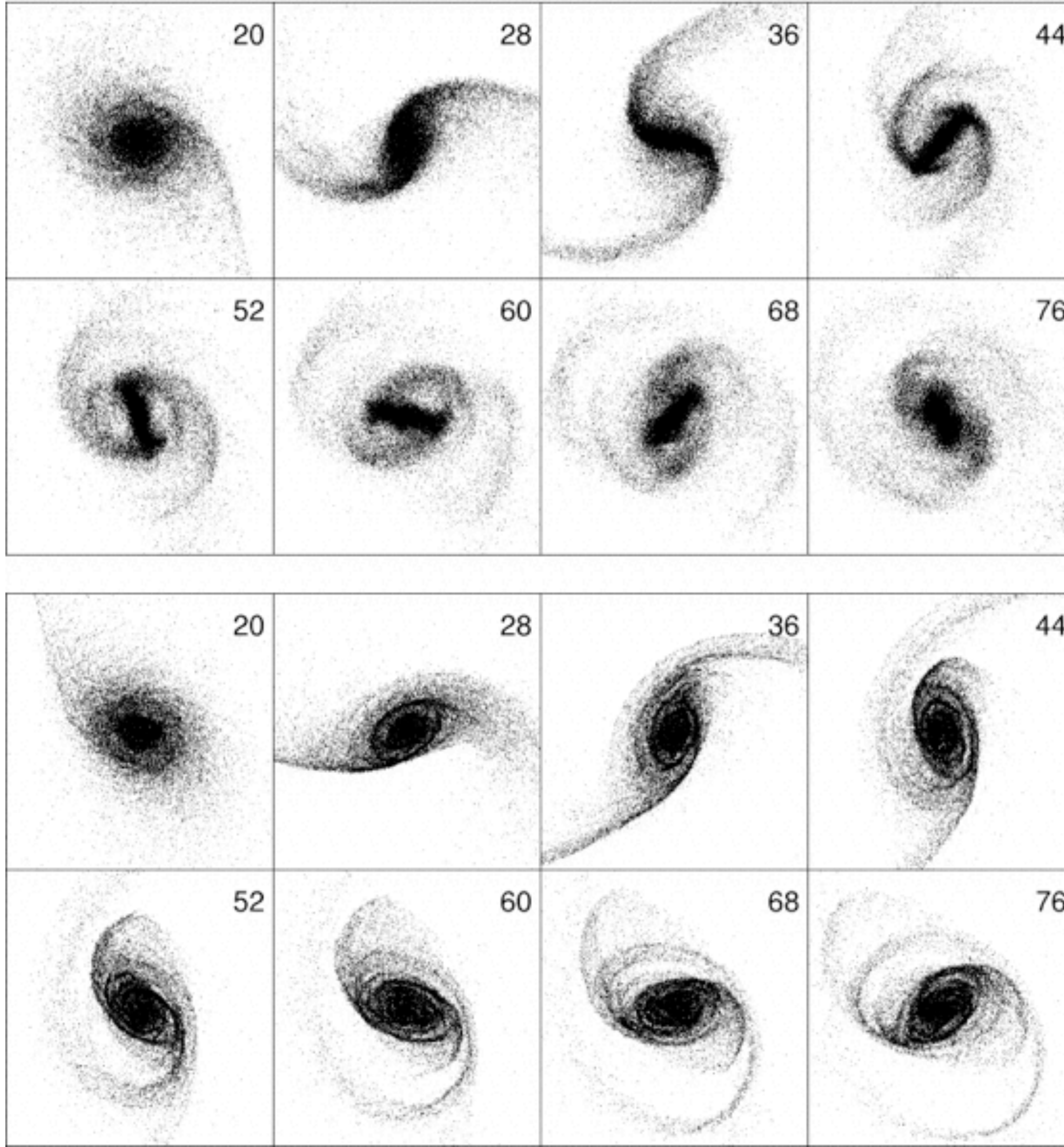


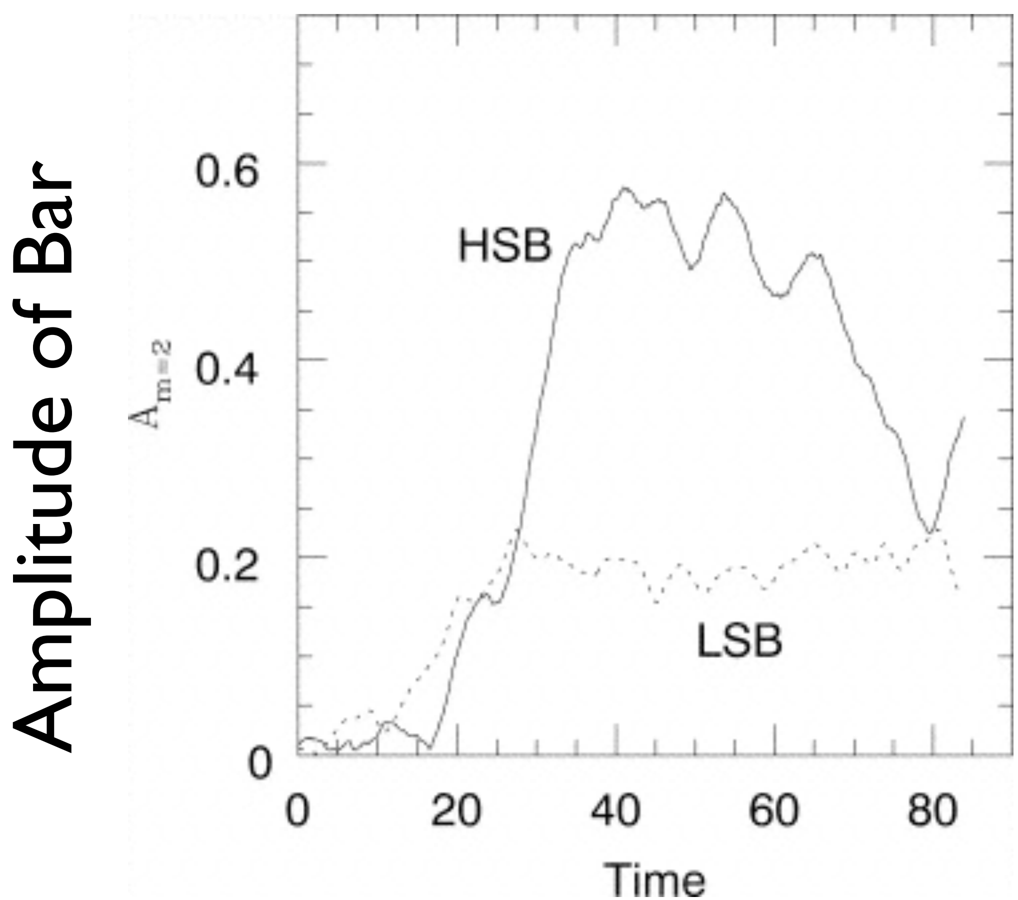
Same rotation curve when radius normalized by scale length

LSB looks more fragile but should be more stable against bar formation because of low surface density

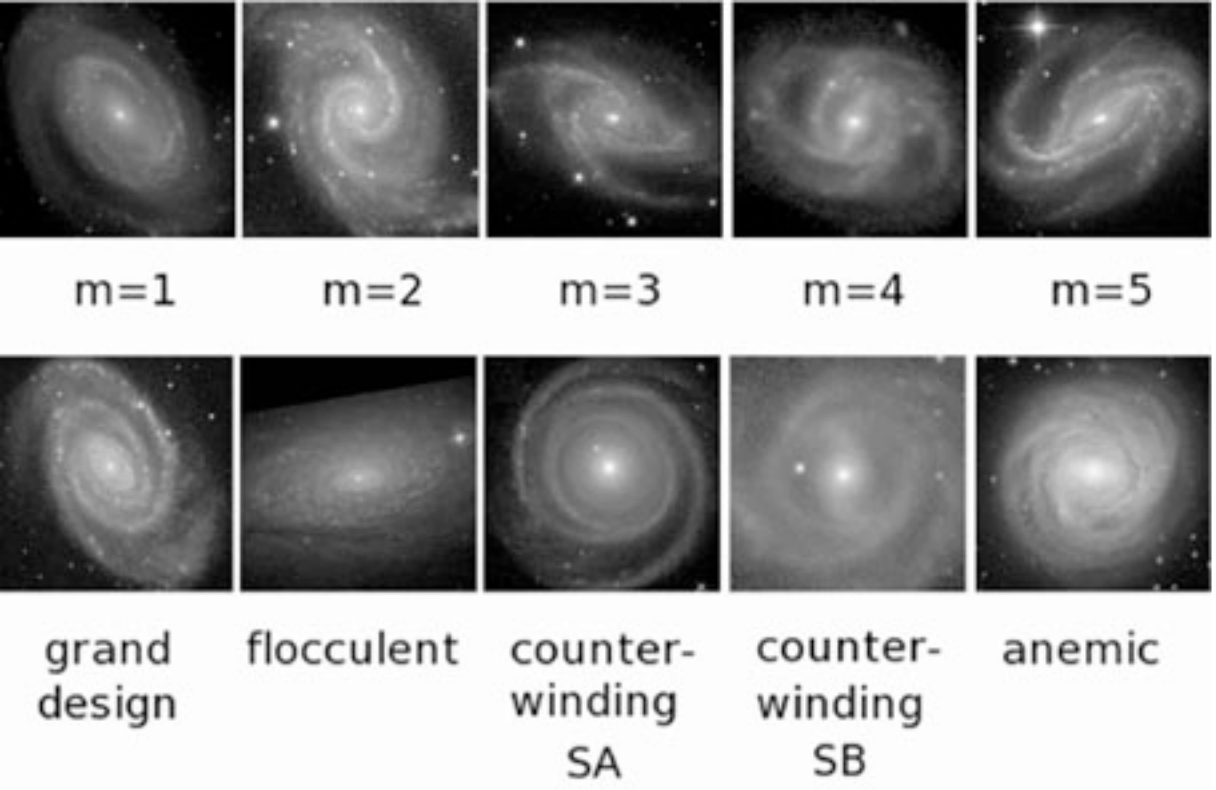
High surface density

Low surface density



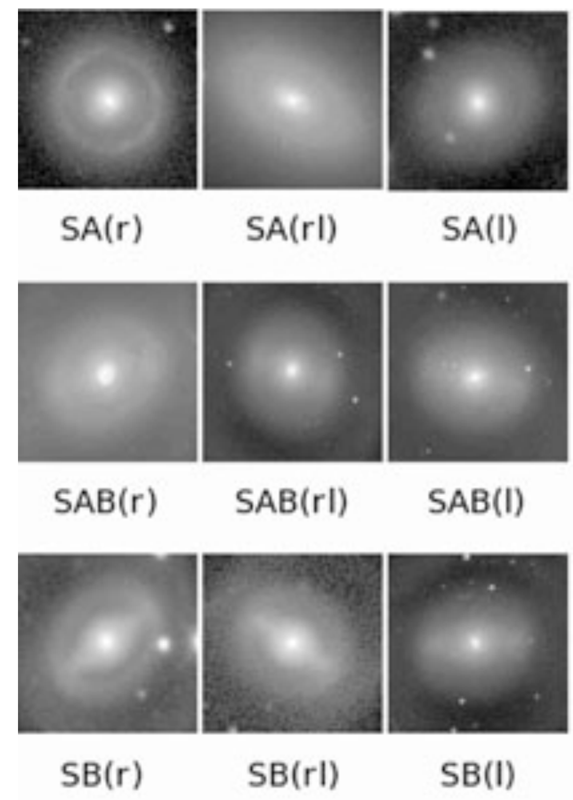


Amplitude of Bar
$A_{m=2}$
0.6
0.4
0.2
0
0
20
40
60
80
Time
HSB
LSB

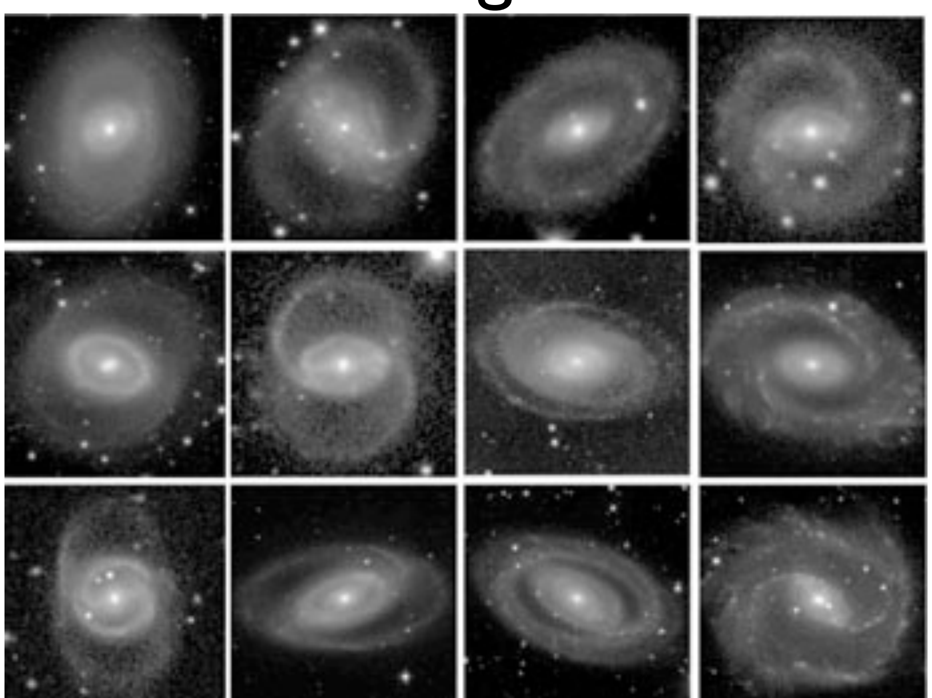


spiral arm
type & multiplicity

lenses



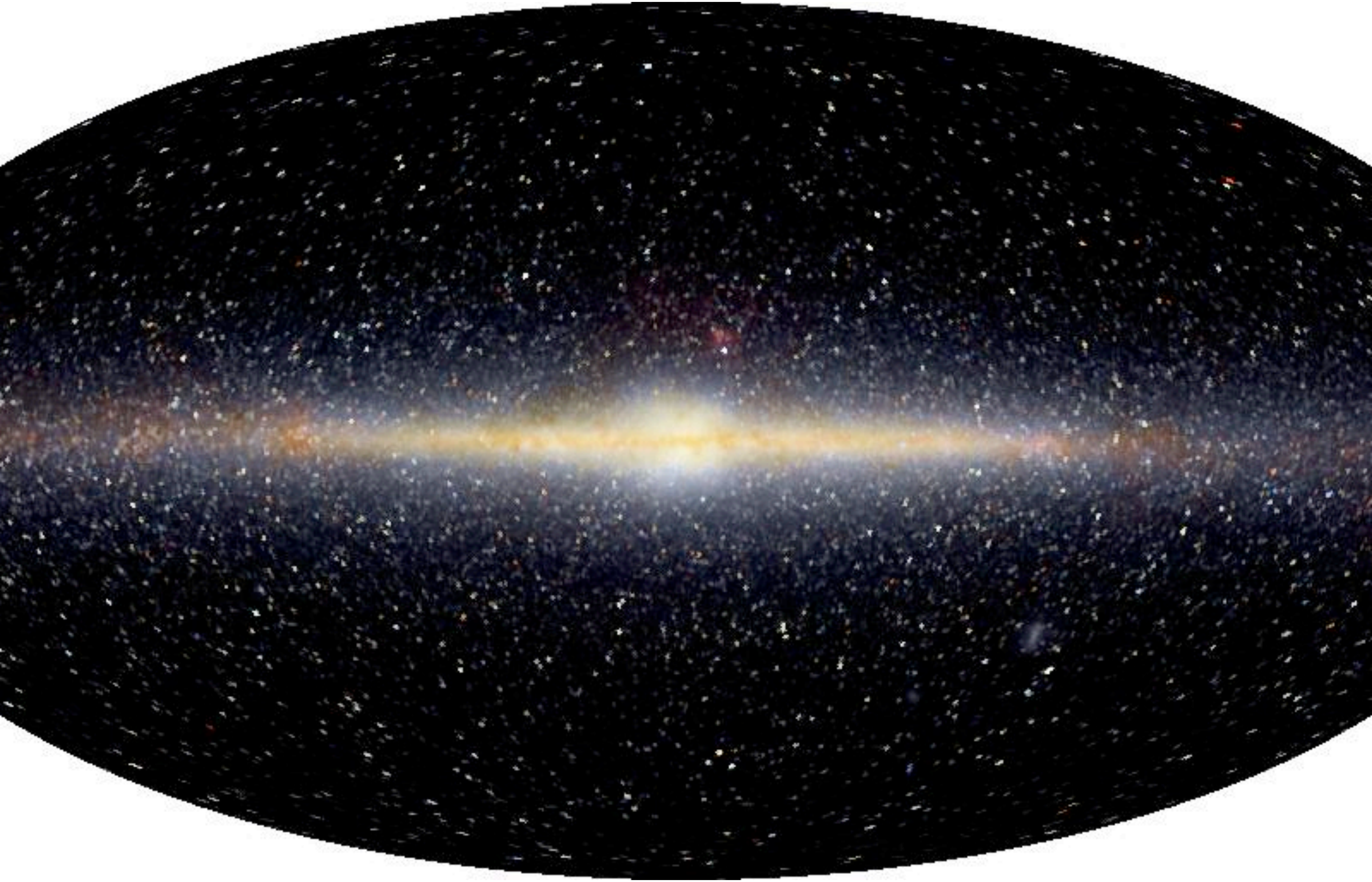
rings



Tracers of the Potential Φ

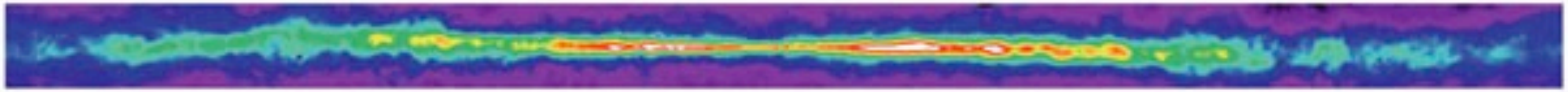
- Photometric
  - Mass you can see
    - Stars (stellar populations, young & old)
    - Gas (Atomic HI & Molecular H_2/CO)
- Kinematic
  - Velocities you can trace (Doppler effect)
    - HI
    - Hα
    - Absorption lines (especially from stars)

Milky Way in the near-infrared



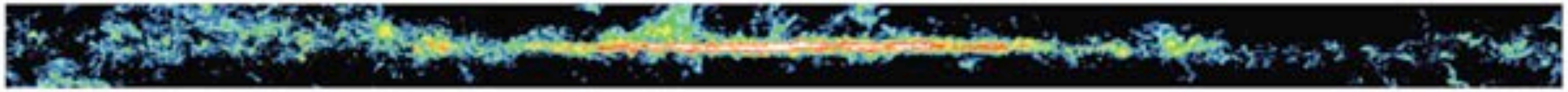
Multi-wavelength Milky Way

radio (21 cm)
HI gas



a 21-cm radio emission from atomic hydrogen gas.

radio (CO)
molecular gas



b Radio emission from carbon monoxide reveals molecular clouds.

far-IR
dust

c Infrared (60–100 μm) emission from interstellar dust.

near-IR
stars

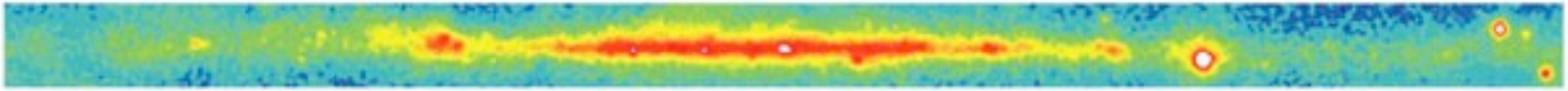
d Infrared (1–4 μm) emission from stars that penetrates most interstellar material.

Optical
stars & dust

e Visible light emitted by stars is scattered and absorbed by dust.

X-ray
hot gas

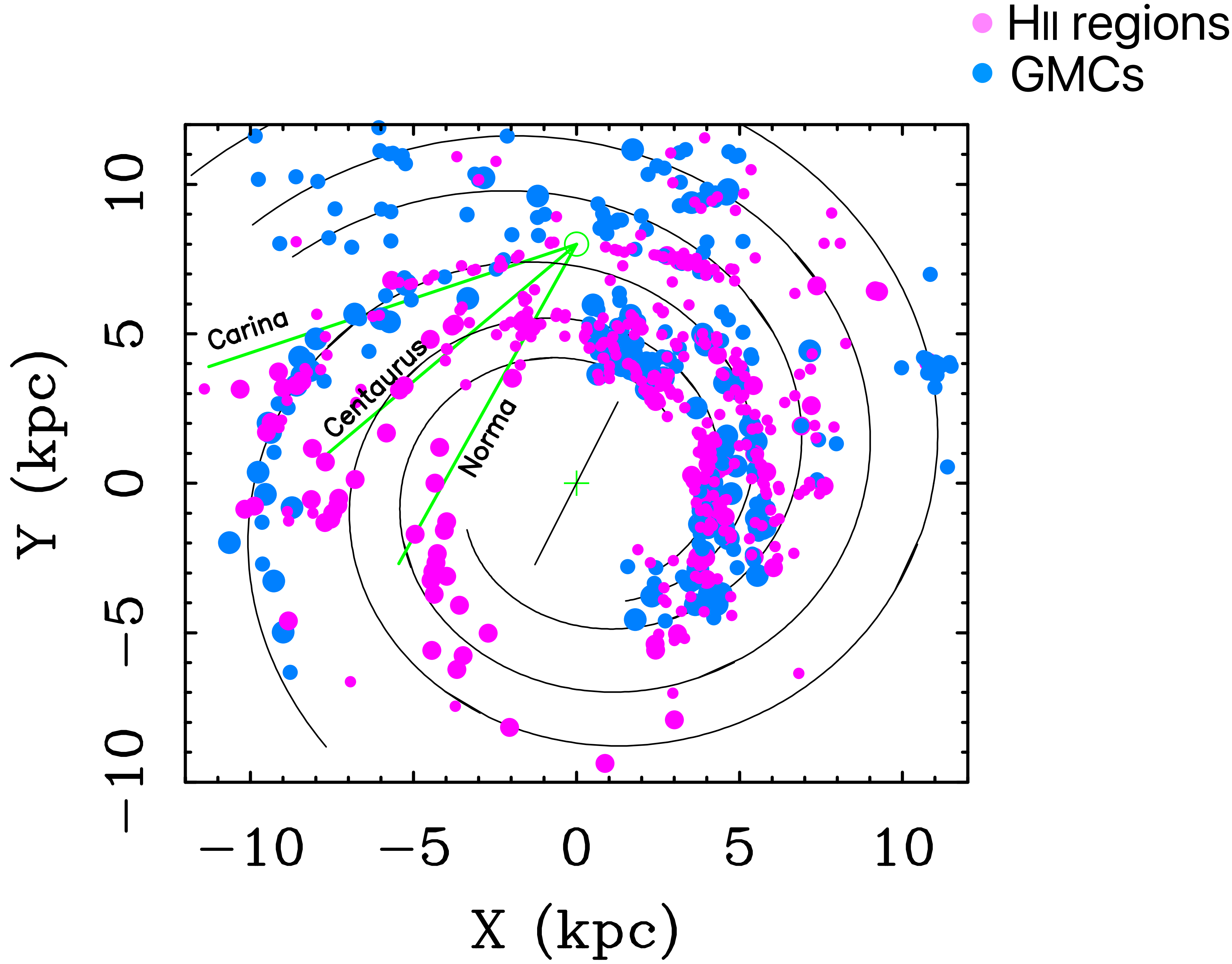
f X-ray emission from hot gas bubbles (diffuse blobs) and X-ray binaries (pointlike sources).



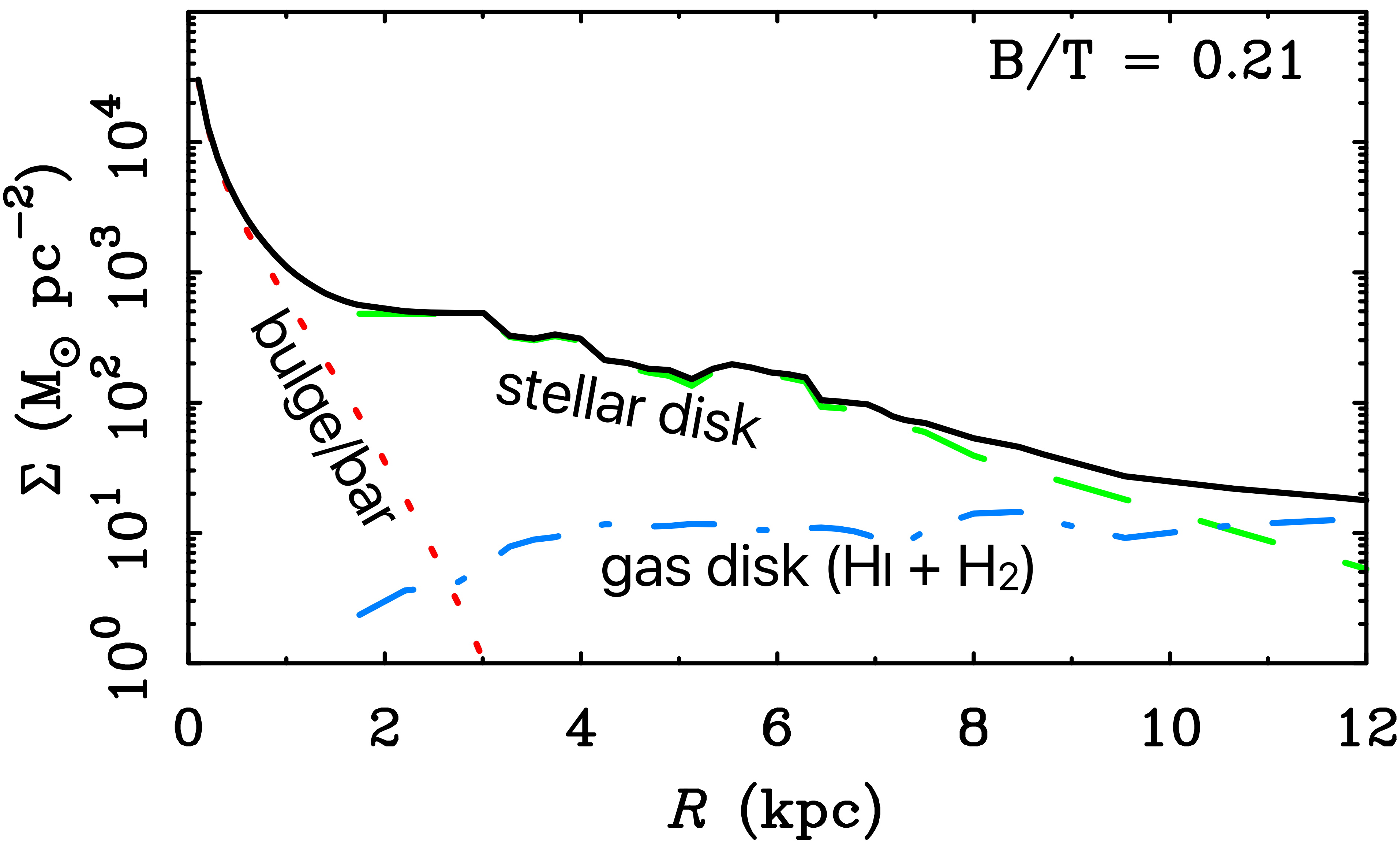
g Gamma-ray emission from collisions of cosmic rays with atomic nuclei in interstellar clouds.

Face-on Milky Way

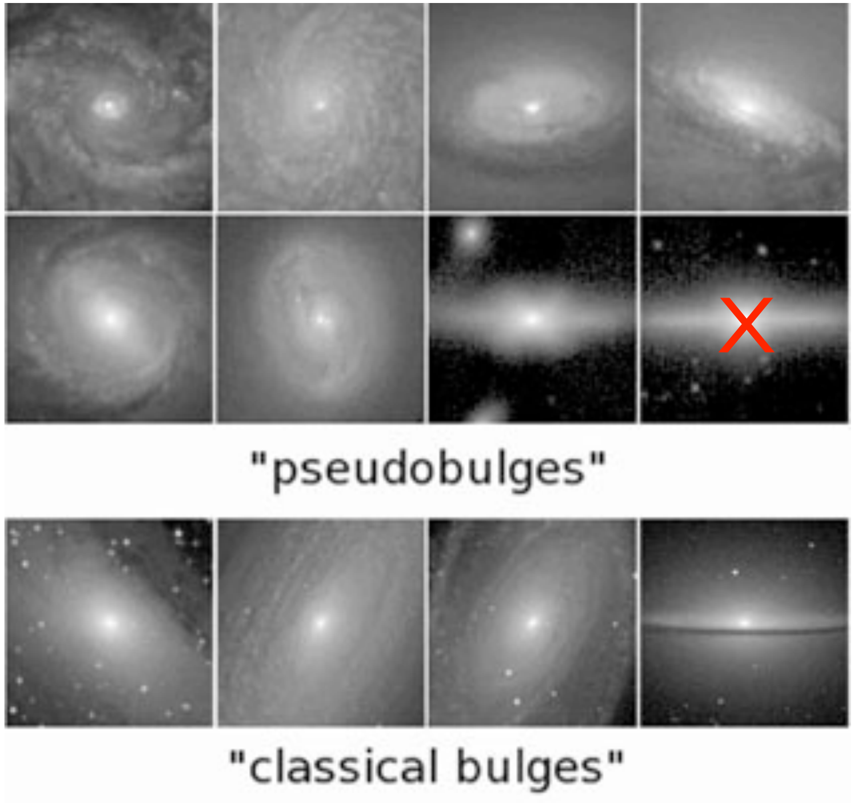
(artist's conception)


HII regions
GMCs
Carina
Centaurus
Norma
Y (kpc)
X (kpc)
10
5
0
−5
−10
−10
−5
0
5
10

Milky Way model illustrating baryonic mass components



Pseudo-bulges have various Sersic indices, often closer to n=1 (exponential) than to n=4 (de Voucoulers profile)



X/peanut shape characteristic of bars seen edge-on

Classical bulges tend to have Sersic indices closer to n=4 (de Voucoulers profile)