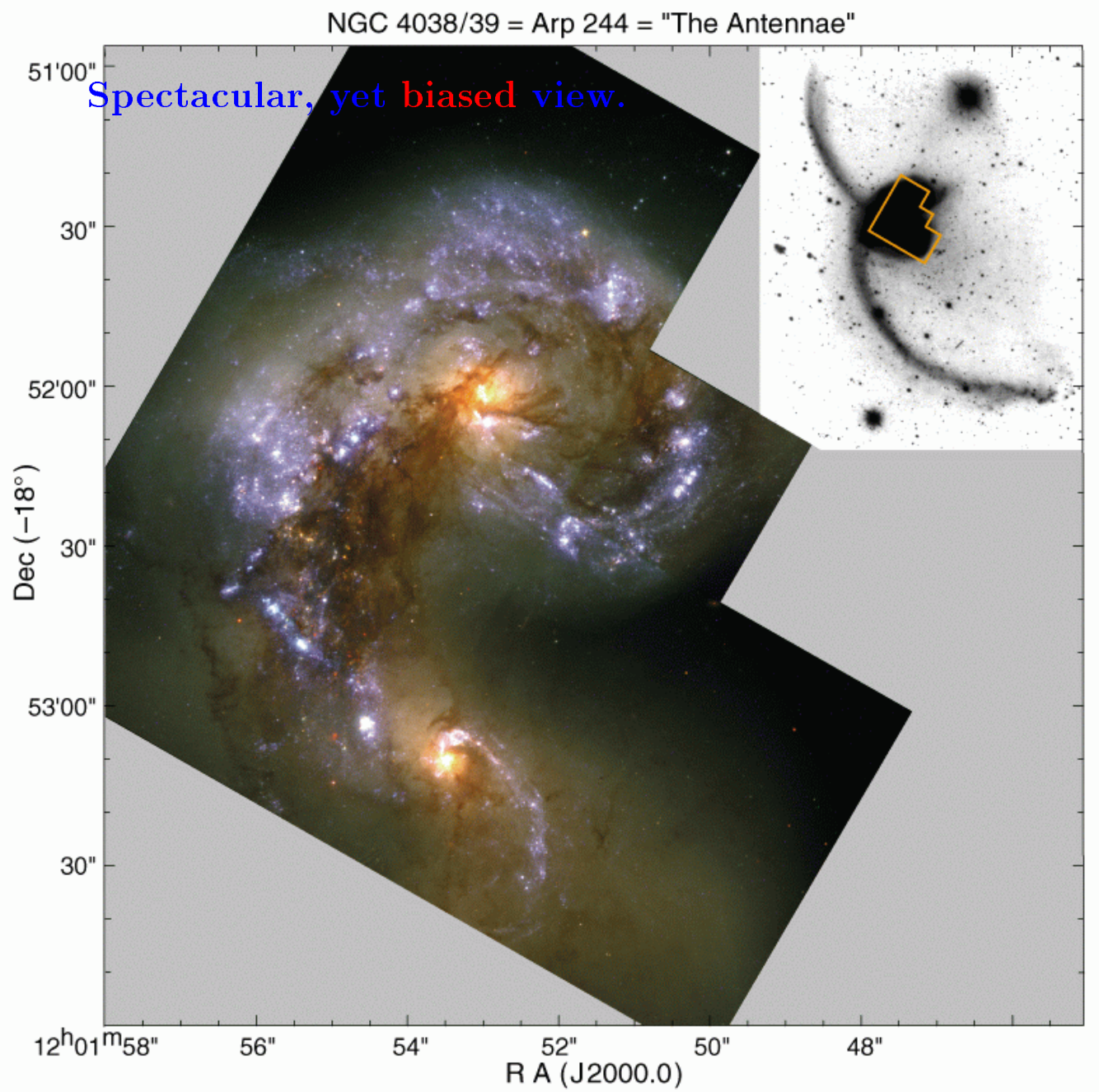
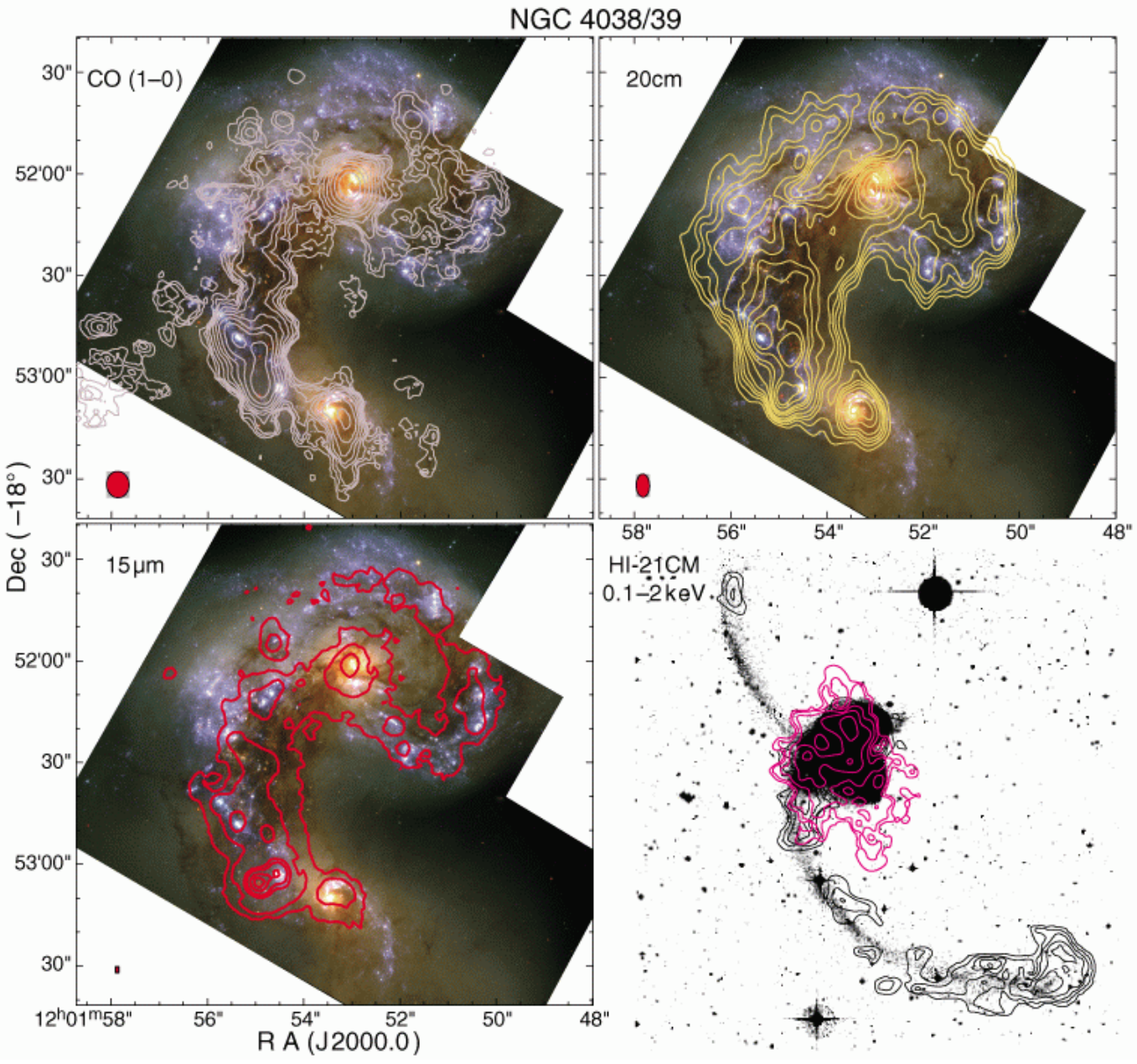
The Gas Concentrations in the Disk-disk Overlapping Regions

Yu Gao
IPAC, Caltech



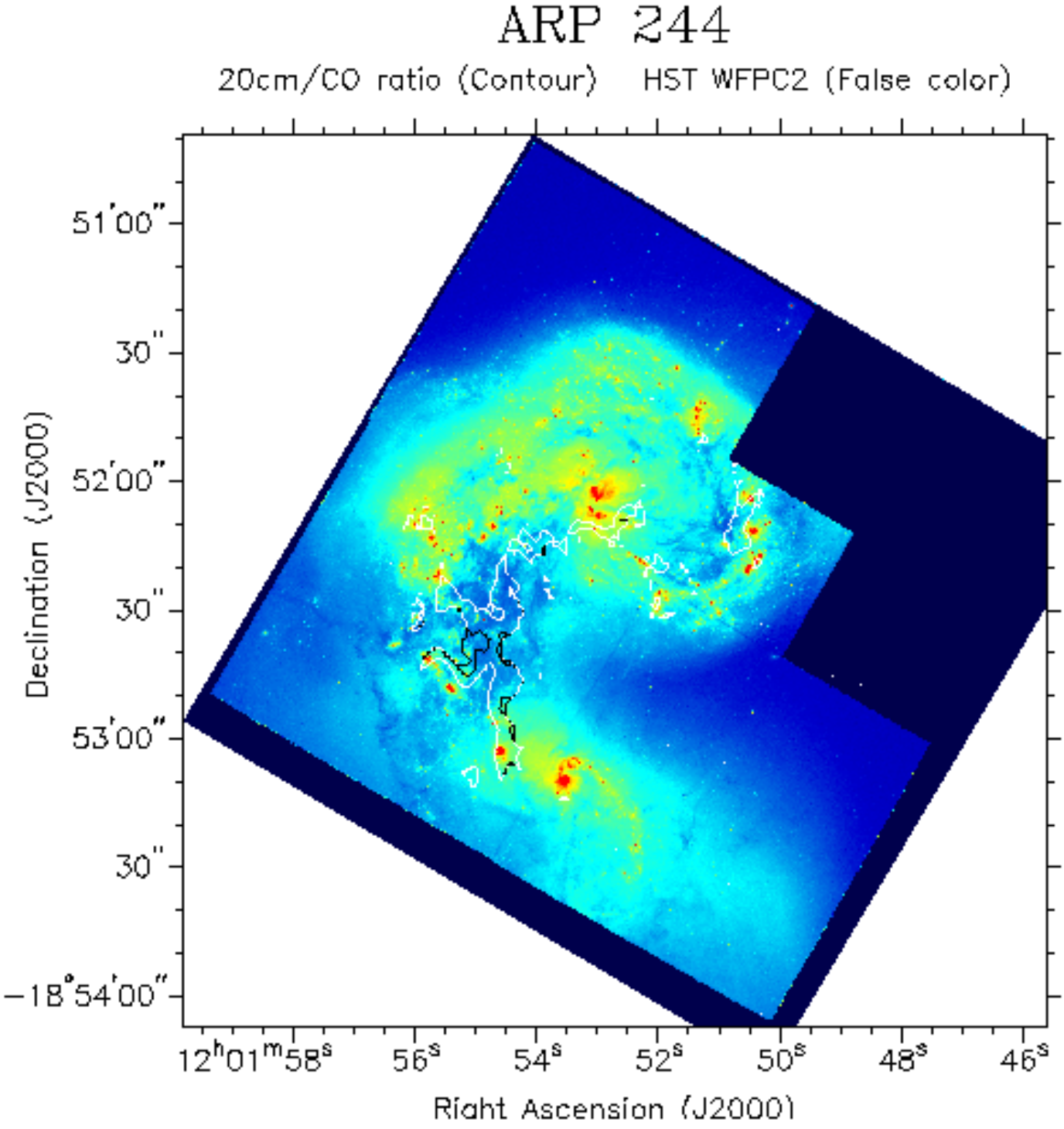
Multiwavelength View of Arp 244

The bulk of emission is from the obscured overlap region where most of star forming molecular gas ($\sim 60\%$) is concentrated.



Starburst Sites: Overlap Regions

Derive local SFE ($L_{\rm IR}/{\rm M}({\rm H}_2)$) using FIR/radio correlation (Gao et al. 2001, ApJ, 548, 172)



Talk Outline

Introduction:

- The Antennae Galaxies
- Overlap Starburst

More Examples: Overlap Concentrations:

- HI Gas Concentrations in Early Mergers
- H_2 Concentrations Outside Merging Disks
- H_2 Concentrations in Disk-disk Overlap

Merger Sequence?

- Overlap Observed in all Merging Stages
- HI between Galaxy Pairs $\rightarrow$ H_2 in Disk Overlap $\rightarrow$ Gas Concentration between Double-nucleus

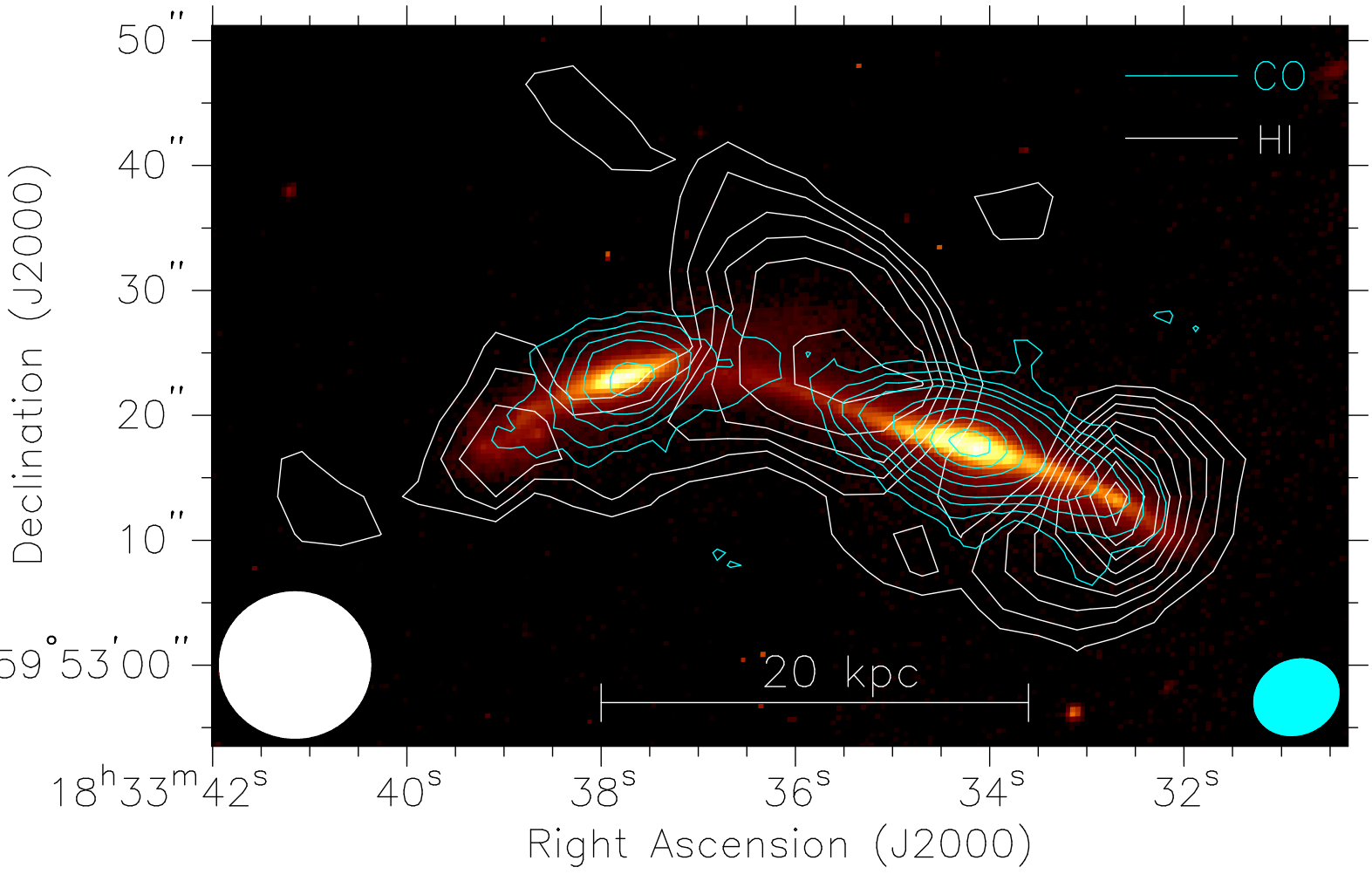
Simulations/Models?

- Overpressure Compression of GMCs?
- Overlap $\sim$ Dynamical Center

Summary

HI Concentrations between Galaxies: NGC 6670

Extended HI Disks Merge First in Early Mergers and the Interaction Zone is close to the Center of Gravity.
Wang, Lo, Gao, & Gruendl 2001, AJ (July, astro-ph/0103280)

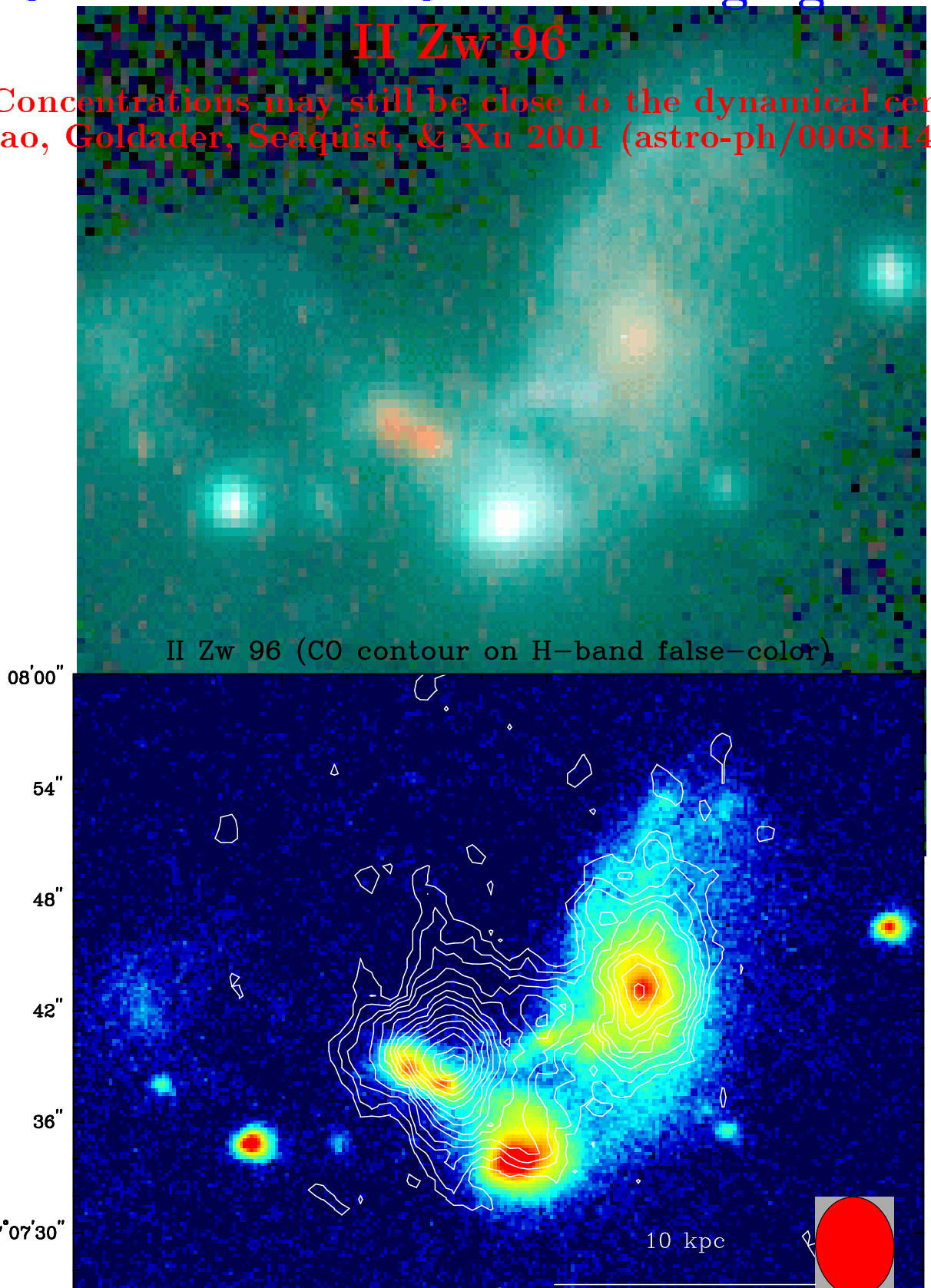


H_2 Concentrations Outside Merging Disks:

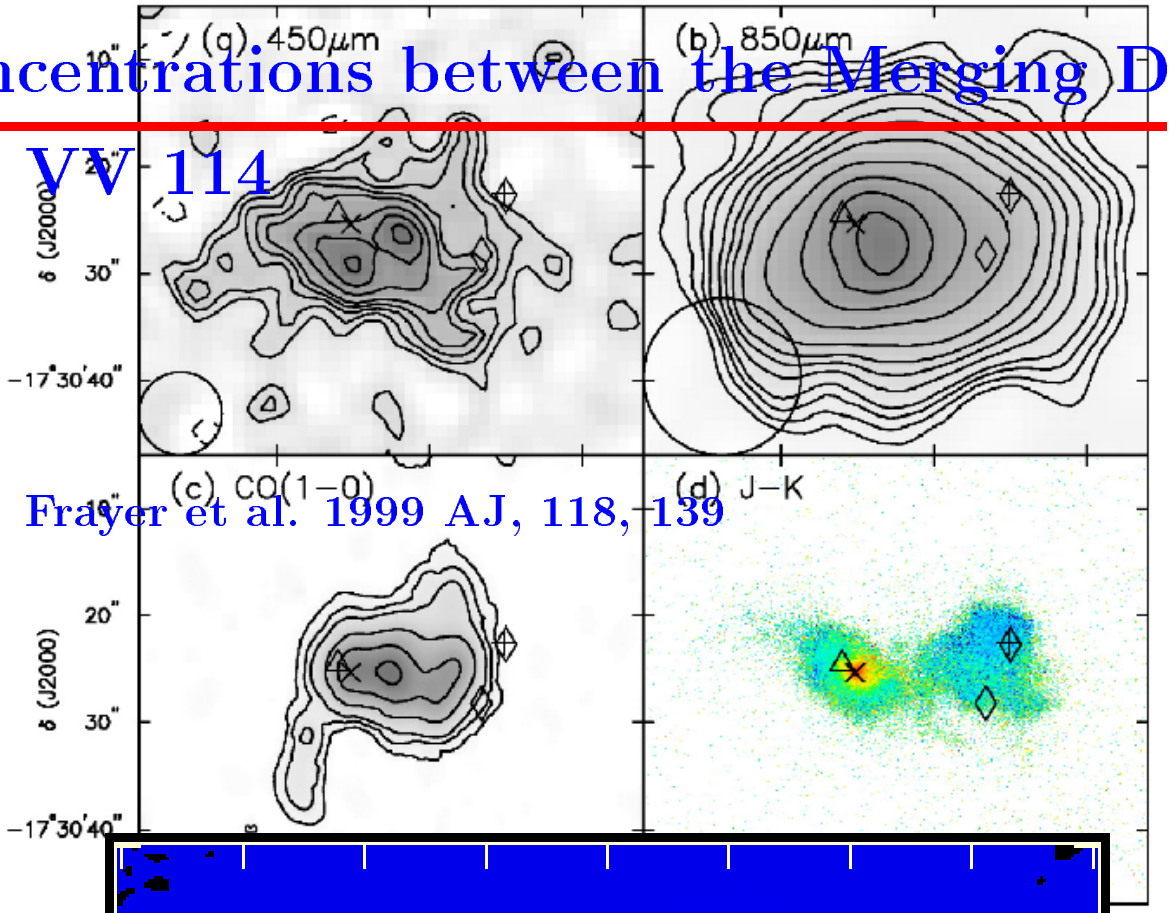
II Zw 96

H_2 Concentrations may still be close to the dynamical center

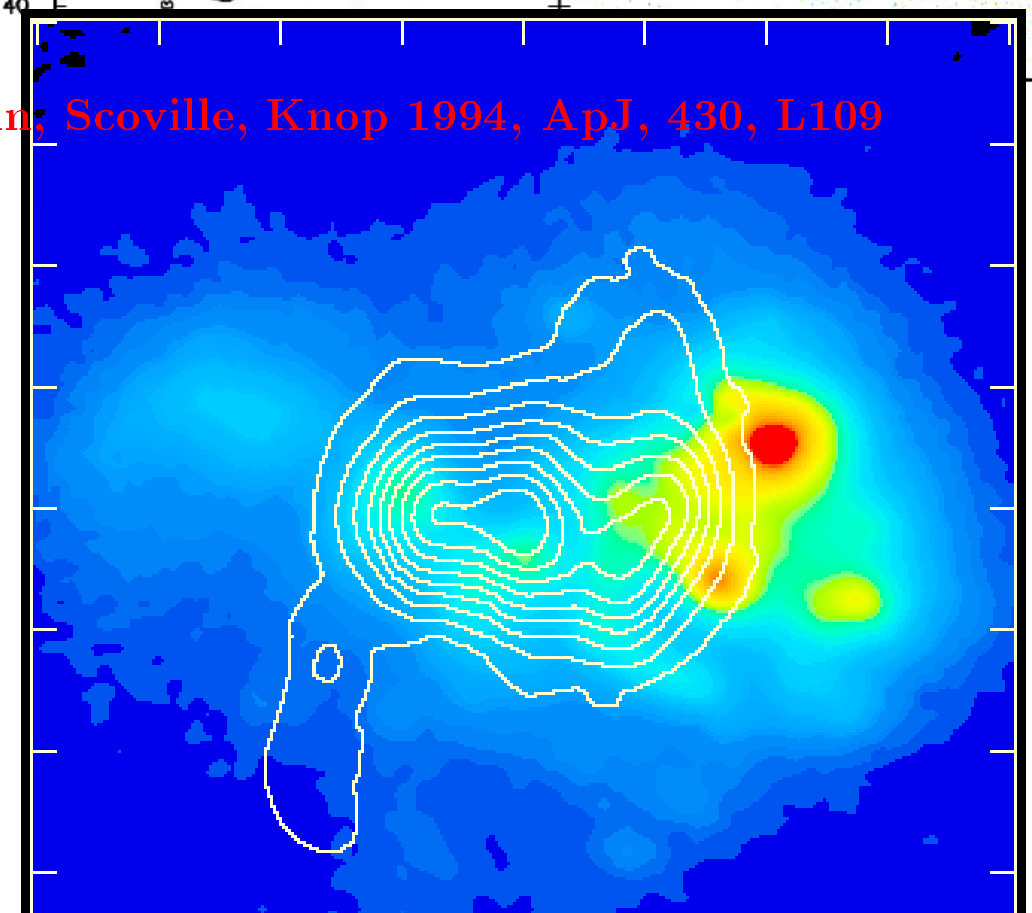
Gao, Goldader, Seaquist, & Xu 2001 (astro-ph/0008114)



H_2 Concentrations between the Merging Disks: VV 114

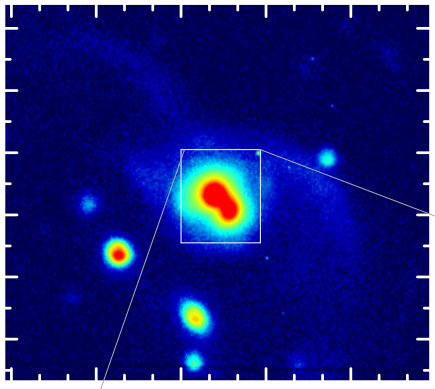


Frayer et al. 1999 AJ, 118, 139

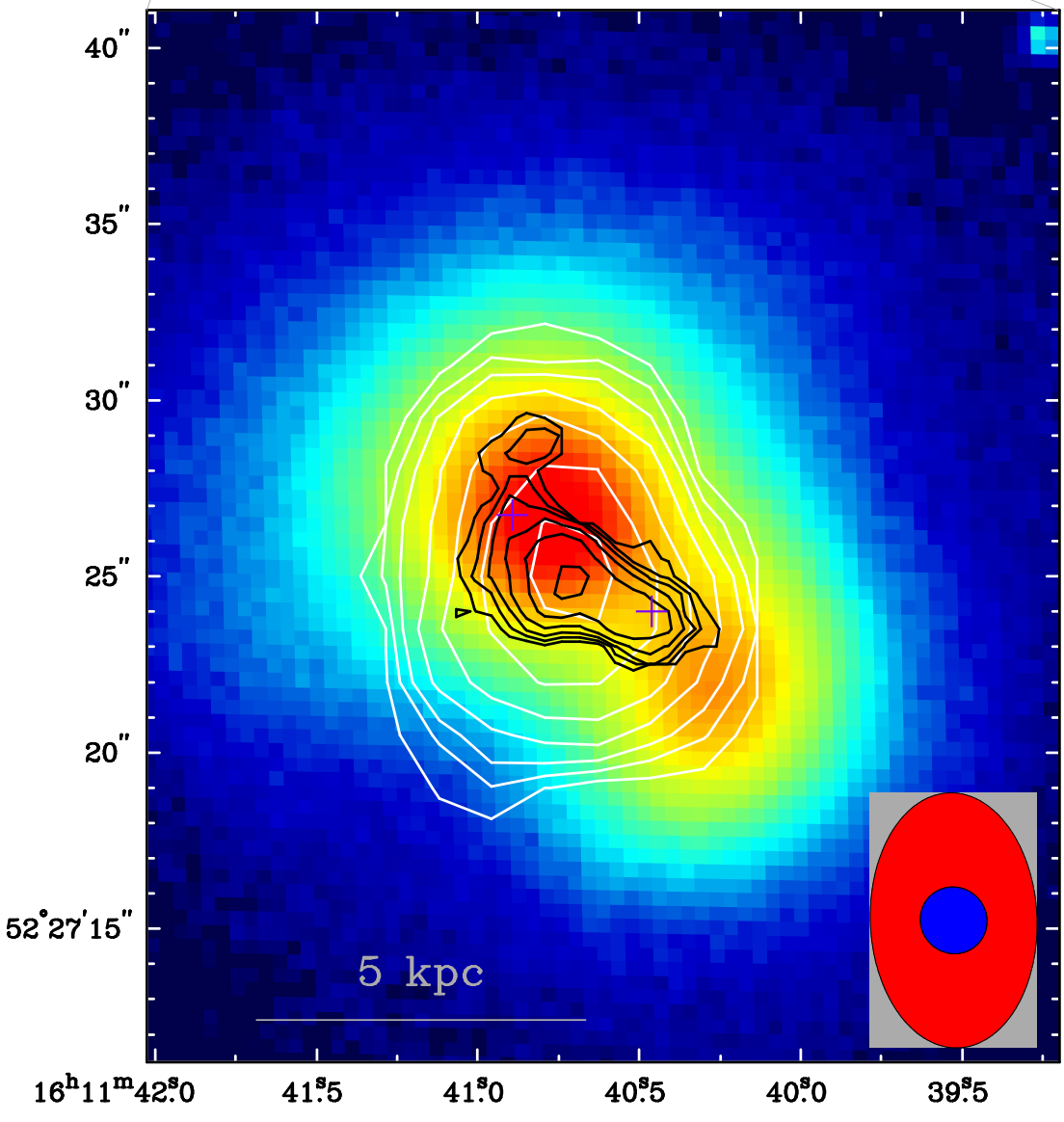


Yun, Scoville, Knop 1994, ApJ, 430, L109

H_2 Concentrations between the Merging Disks:

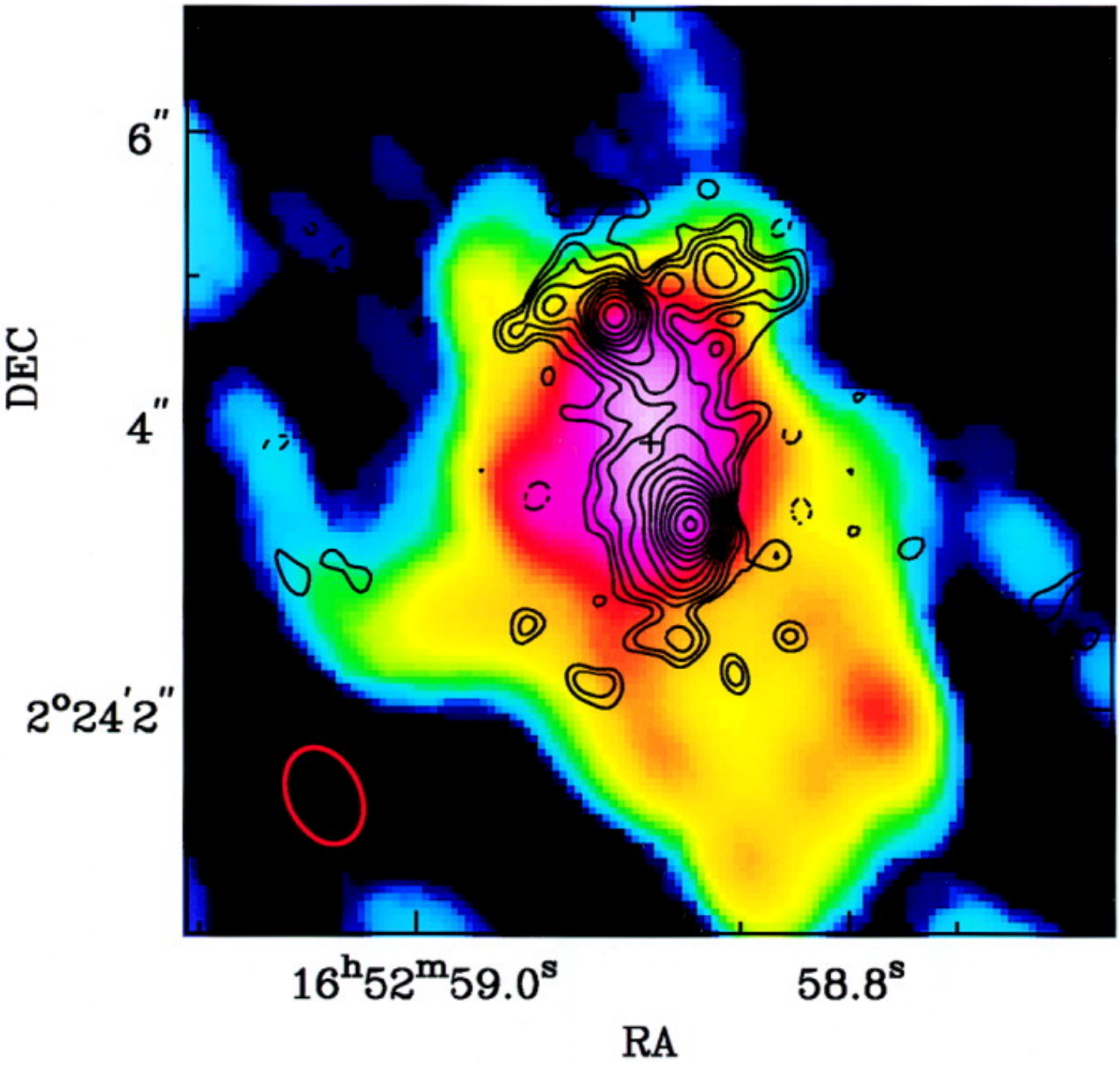


NGC 6090 — Another Antennae



H_2 Overlap Concentrations in Late Mergers: NGC 6240

Tacconi et al. 1999, ApJ, 524, 732



SUMMARY

- Gas concentrations in the overlap regions are quite often observed ($> 15\%$, 6 out of < 40?). Perhaps much higher fraction with less dramatic overlap concentrations (Xu et al. 2000).

- Bulk emission is from gas concentrations in the overlap regions. Strongest starburst sites are also in the confined regions of the overlap: Overlap starburst.

- Merger Sequence? HI concentrations between disks $\rightarrow$ H_2 concentrations in the disk-disk overlap regions $\rightarrow$ Huge gas concentration between the double-nucleus.

- Overlap Regions: dynamical center of the entire merging systems? Do most gas-rich mergers go through the overlap starburst phase? Numerical simulations!?

- From Overlap Starburst (Overpressure compression of GMCs, Jog & Solomon 1992) to Extreme Starburst (Downes & Solomon 1998) of GMCs collision?