# Physics of Groups and Galaxy Properties therein – some closing thoughts



Trevor Ponman

A personal thankyou

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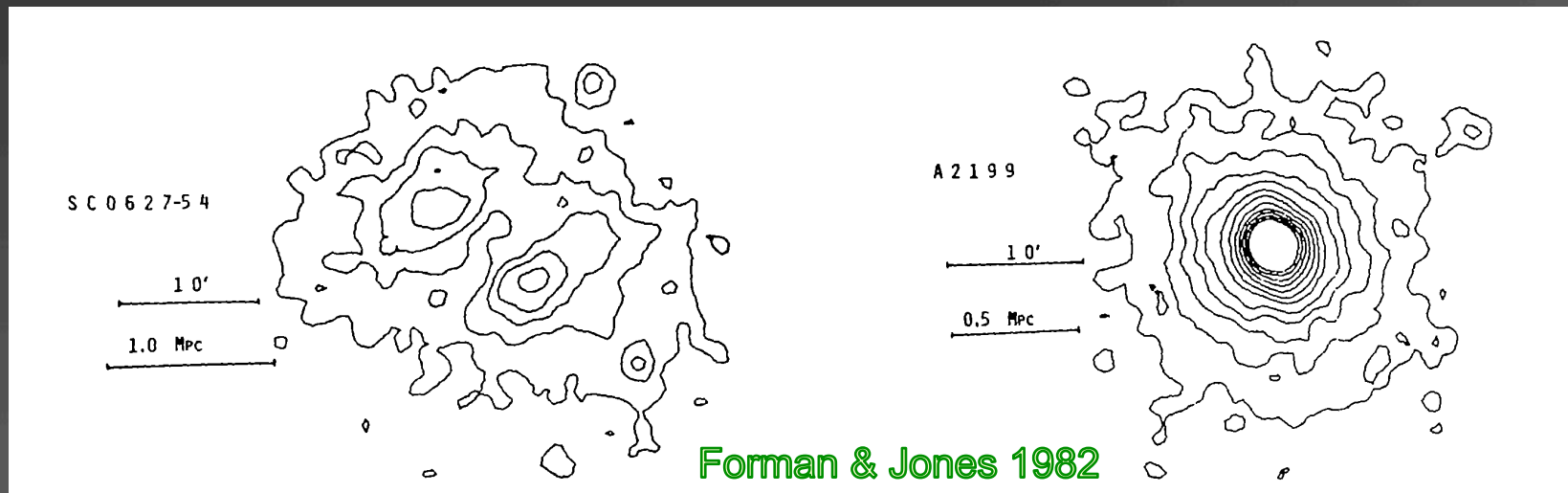
26 years ago...

# The way we were...

- I started work on Galaxy Groups with the launch of ROSAT in 1990.

- At that time, X-ray properties of groups were virtually unknown.

- Bill and Christine had done some great work on hot gas in clusters with the Einstein IPC.
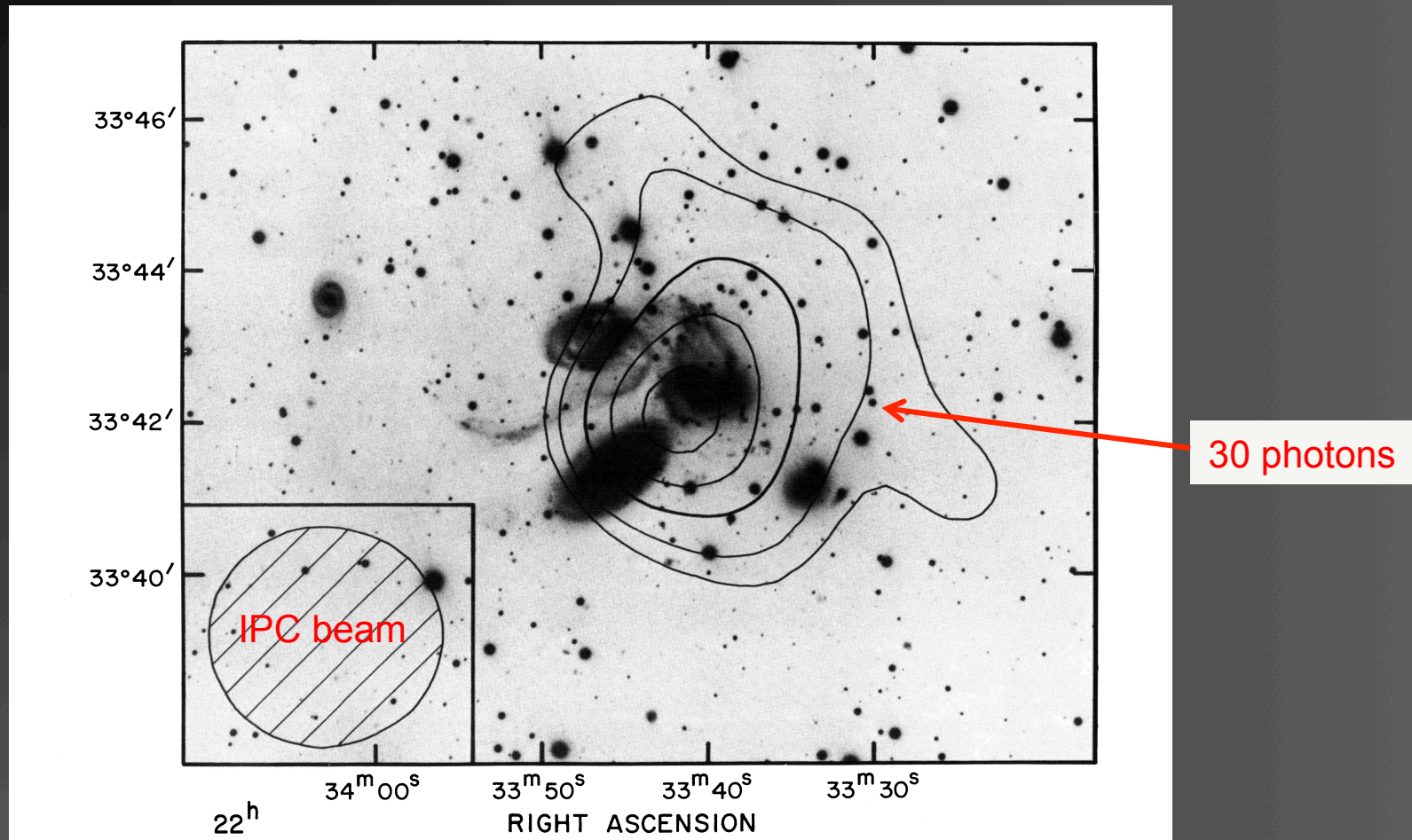


Forman & Jones 1982

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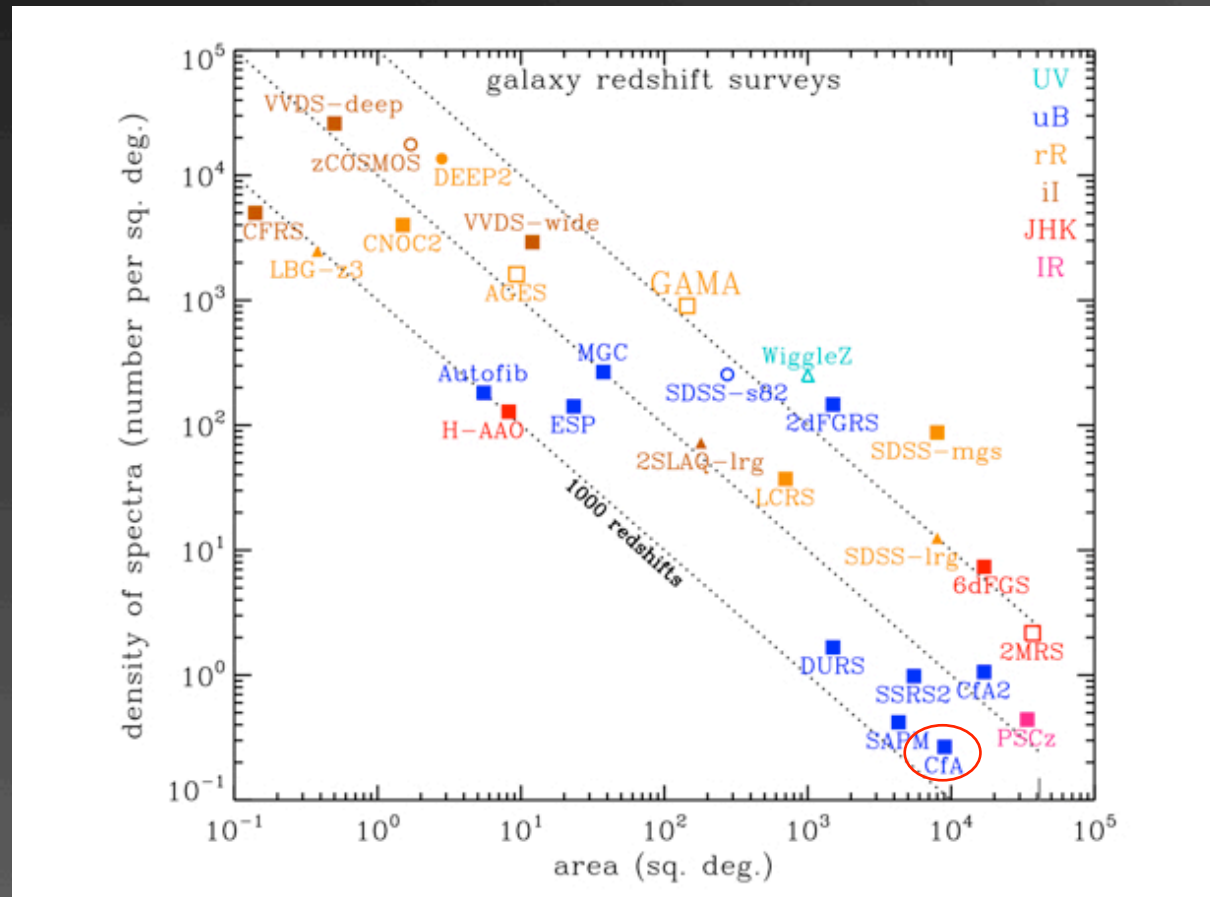- X-ray emission had been detected in a few groups and poor clusters, but little was known about its origin

# The way we were...



Stephan's Quintet - Bahcall, Harris & Rood 1984

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- Geller and Huchra did some pioneering grouping analyses on their survey, extracting samples of ~100-200 groups

- However, spurious groups were a major concern, and most studies of the impact of the group environment on galaxies in the 1980s had been conducted on the Hickson compact groups by Paul Hickson and collaborators

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## ARE COMPACT GROUPS OF GALAXIES PHYSICALLY DENSE?

### GARY A. MAMON
Princeton University Observatory and New York University
*Received 1985 September 30; accepted 1986 January 31*

#### ABSTRACT

The properties of the compact groups of galaxies cataloged by Hickson (1982) are compared to the output of over 1000 numerical simulations of small groups of galaxies. Rather than being dense physical systems or transient unbound cores of loose groups, it is argued that roughly half of the compact groups in Hickson's catalog are simply chance alignments of galaxies within loose groups.

groups by Paul Hickson and collaborators

- Gary spent much of his time worrying about the status of these groups...

# The way we were...

- Meanwhile, cosmological simulations had been largely confined to dark matter until the late 1980s, when Gus was in the vanguard of those introducing baryons

## FORMATION AND EVOLUTION OF X-RAY CLUSTERS: A HYDRODYNAMIC SIMULATION OF THE INTRACLUSTER MEDIUM

AUGUST E. EVRARD

Department of Astronomy, University of California, Berkeley

A personal thankyou

26 years ago…

Future challenges

# Some problems we face

### Observation

- Selection effects & biases
- Missing information
 - 3D locations
 - Galaxy orbital histories
 - Group merger histories

### Simulations

- Dynamic range
- Poorly understood physics
- Adjustable parameters
- Physical interpretation

### Theory

- Spherical cow assumptions



- Poorly understood physics
- Complex feedback loops

# Points for discussion

- You can't correct for selection unless you know what you are missing!

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  ➜ Beware of "self-calibration" approaches. Simulations have a key role to play here.

- How best to compare between simulations and observations?

  ➜ It's tempting but dangerous to make use of the extra information (e.g. d.m. distribution) available in simulations to provide "better" (but observationally inaccessible) defininitions. [e.g. of what a "group" is]

# Points for discussion

- Language matters, since it shapes our thoughts – e.g. "quenching" suggests something that is <u>done to</u> galaxies.

  → Try to be clear and consistent in definitions (e.g. don't confuse groups and halos) and do not be led too easily by loaded terms

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- How can we explore the <u>uniqueness</u> of model solutions?

  ➔ Modelling has to be more than a fitting operation

# Thanks to Gary and Pierre