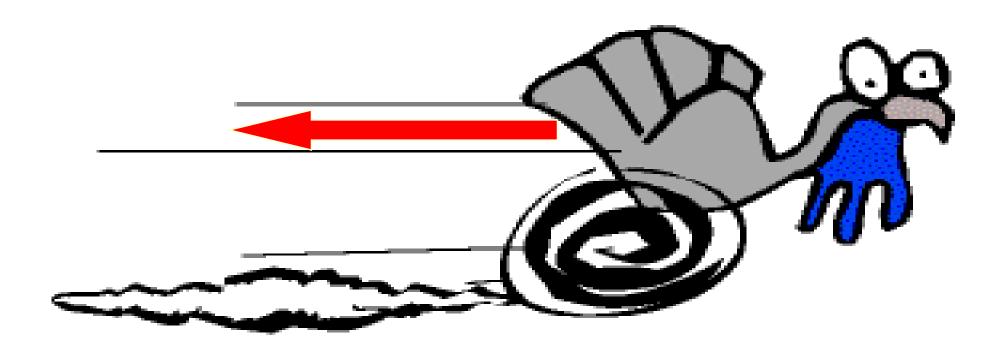


The Doppler Effect



3. Question: What is the statistical significance of the examples being cited?

The Sloan Digital Sky Survey (SDSS), immediately introduced millions of objects to the field of study. Amongst them were more than 40 000 positively identified quasars. The two deep field surveys are also invaluable sources of redshift data. The 2dF Galaxy Redshift Survey (2dFGRS) lists ~250 000 galaxies, and the 2dF Quasar Redshift Survey (2QZ) examines ~25 000 quasars.

4. What are anomalous redshifts?

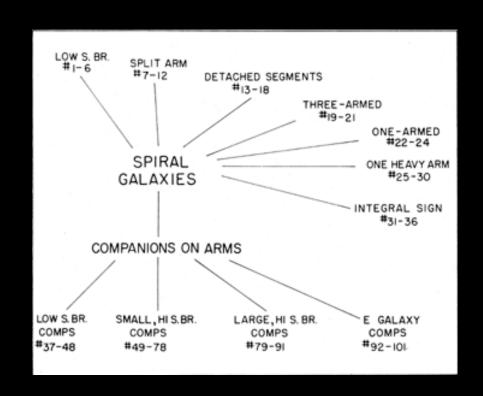
Anomalous redshifts are defined as quantities significantly at variance with the Hubble Law.

To assess whether an apparent system is or is not anomalous, we would look for "properties of nearness, alignment, disturbances, connections."

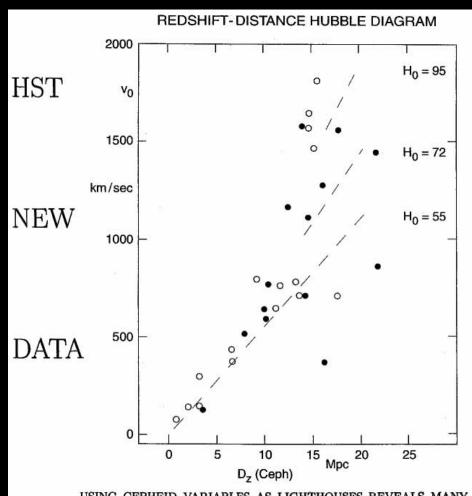
(Arp, Burbidge, & Burbidge 2004)

5. Overview

Quasars

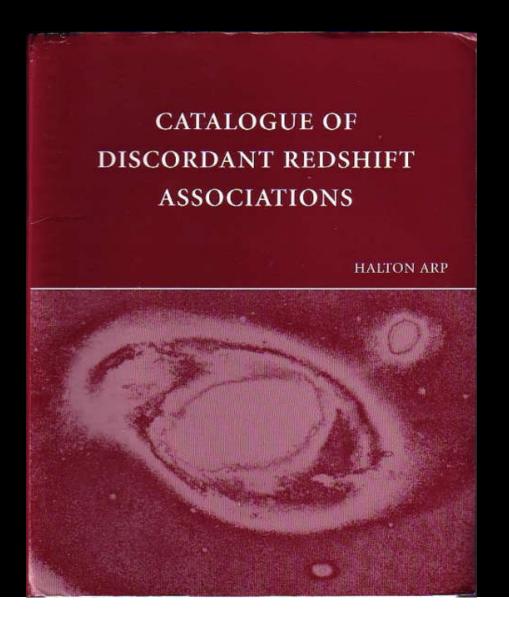


6. A Redshift/Luminosity plot for Quasars



USING CEPHEID VARIABLES AS LIGHTHOUSES REVEALS MANY GALAXIES MUCH CLOSER THAN THEIR REDSHIFT DISTANCES. Sb (filled) AND Sc (open circles) DEFINE $H_0=55~\rm km/sec/Mpc$ WITH SMALL SPREAD IN PECULIAR VELOCITY. THE DEVIATION FOR HIGHER REDSHIFTS CANNOT BE DUE TO PECULIAR VELOCITY.

7. Catalogue of Discordant Redshift Associations 2003



8. Surveys and Catalogues

- •Atlas of Peculiar Galaxies Arp 1966
- Catalogue of Discordant Redshift Associations Arp 2003
- Flesch & Hardcastle 2008
- Catalogue of M51 type Galaxy Associations Russell et al 2008

Sloan Digital Sky Survey and 2dF

9. Statistical distribution

•AM 2230-284 Large quasar family

•NGC 3516 The Rosetta Stone

•Quasars around NGC 5985

10. Statistical distribution

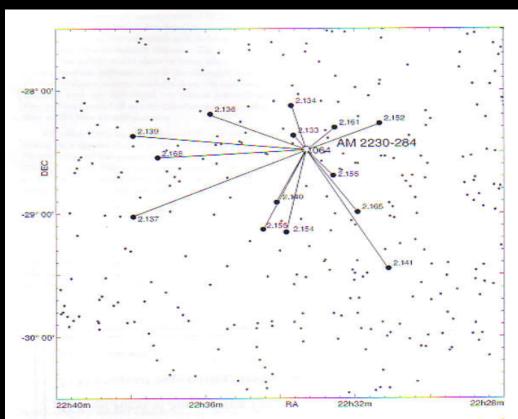
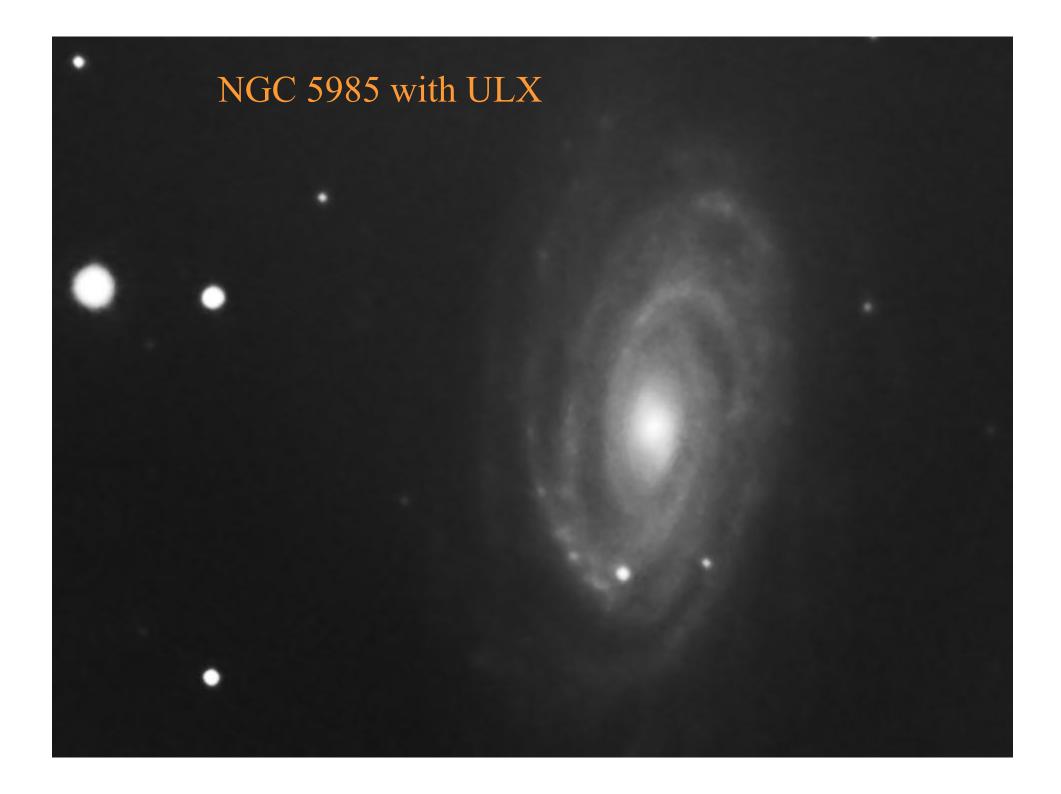


Fig. 3.— An Unprecedentedly Large Quasar Family. All quasars in a 3 × 3 degree 2dF field are plotted as filled circles. Inside 70' and for z between 2.125 and 2.175, the filled circles are larger and labeled with redshifts. Diagram courtesy D. Carosati.

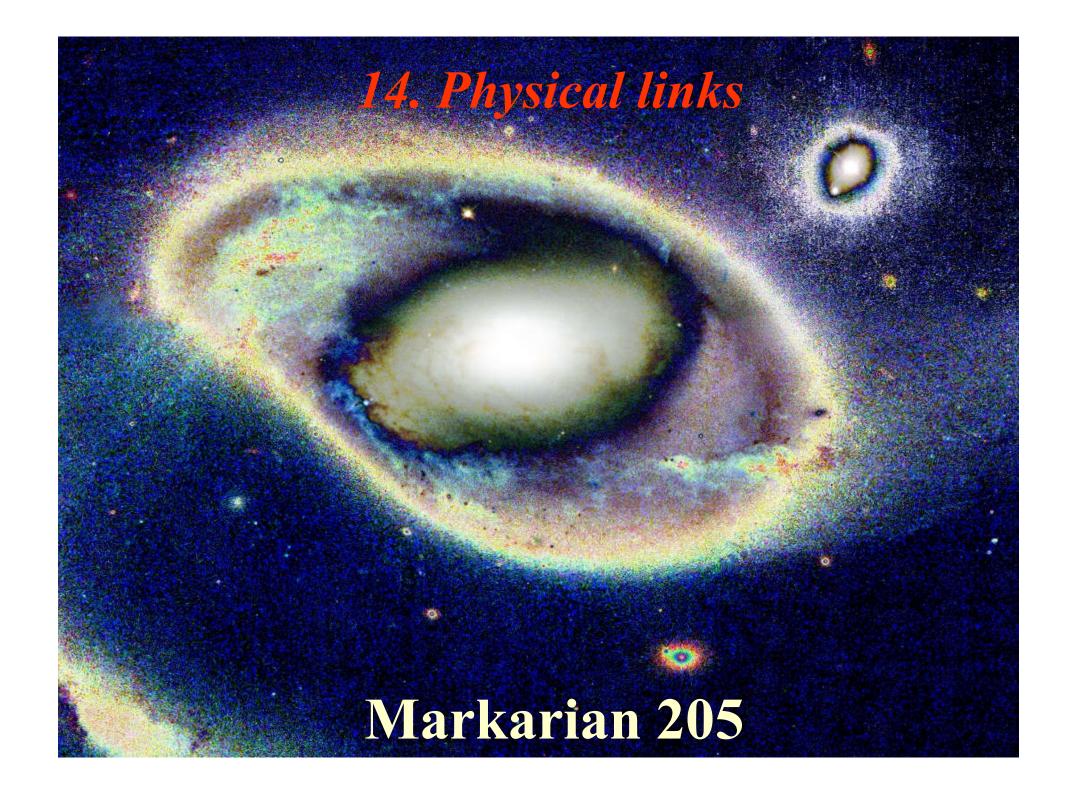
Large quasar family AM 2230-284



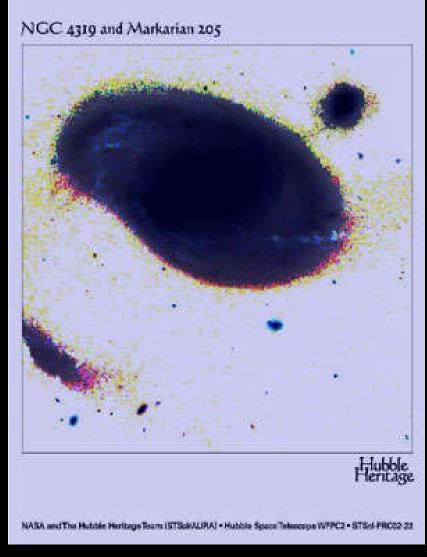


13. Physical associations

- **3.1. Markarian 205**
- 3.2. NGC 7603
- 3.3. Stephan's Quintet
- 3.4. NEQ 3



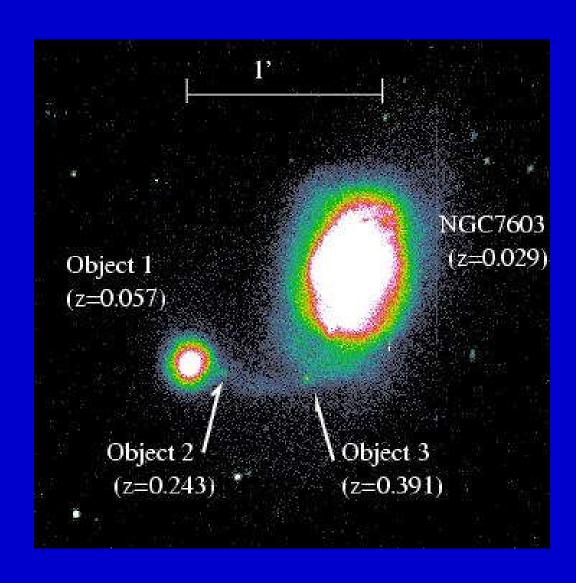


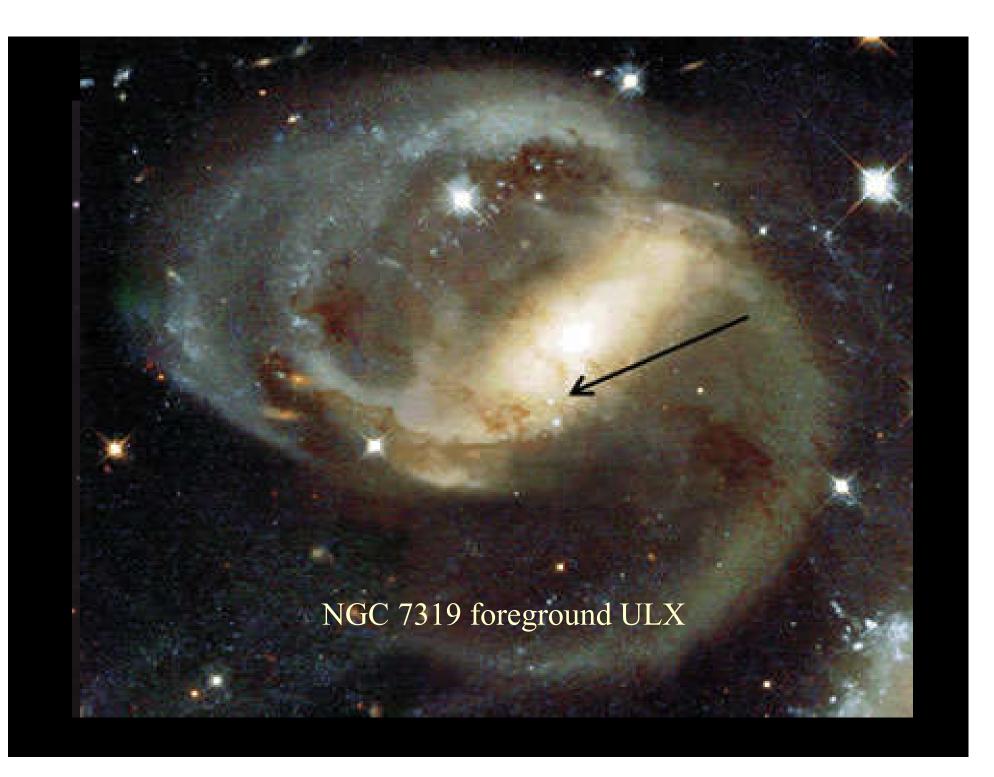


• NGC 4319 and Markarian 205 (HST images)

16. Physical associations

NGC 7603





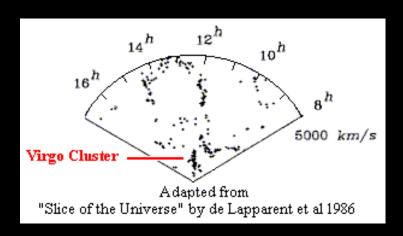
18. NEQ 3

19. Redshift survey of local galaxies

- Tully-Fisher Relationship (TFR)
- •Intrinsic redshifts in normal spiral galaxies
- Redshift deficits by type
- •Adopting a strict velocity interpretation of galaxy redshifts requires that as a group the giant Sb galaxies are approaching the Milky Way with a mean velocity of -898 km s⁻¹ while the giant ScI galaxies are receding from the Milky Way with a mean velocity of +824 km s⁻¹.

20. "Fingers of God"

- J. C Jackson
- N. Kaiser
- Neta Bahcall



21. Notes

- 6.1 Instrument time
- 6.2 Publication
- 6.3 Gravitational lensing
- 6.4 Conspiracy theories

22. Geoffrey Burbidge in the documentary programme *Universe – the Cosmology Quest* 2000

• "If you see two objects close together with very different redshifts, you only have one of two explanations. One is that a large part of the redshift has nothing to do with distance. The other is that it's an accident. So the real issue...is how frequently do you expect to see accidents?"

23. Discussion

- Only one verified exception is neccessary
- Ejection from AGN
- Cosmological Principle
- How do we incorporate anomalous results?

George Chapline, quoted in the book A Different Universe by Robert Laughlin 2005

• The First Theorem of Science: It is impossible to convince a person of any true thing that will cost him money.

25. Steven Weinberg Nobel Laureate, in The First Three Minutes 1977

• "It is difficult to avoid the conclusion that...Hubble knew the answer he wanted to get."

26. M. B. Bell Further Evidence that the Redshifts of AGN Galaxies May Contain Intrinsic Components 2006

Bell's Inequality?

"...astronomers are very reluctant to consider other possibilities."

27. Mary Wollstonecroft Shelly pioneer feminist, author, and wife of poet Percy Bysshe Shelley

• "What a weak barrier truth is when it stands in the way of an hypothesis"

