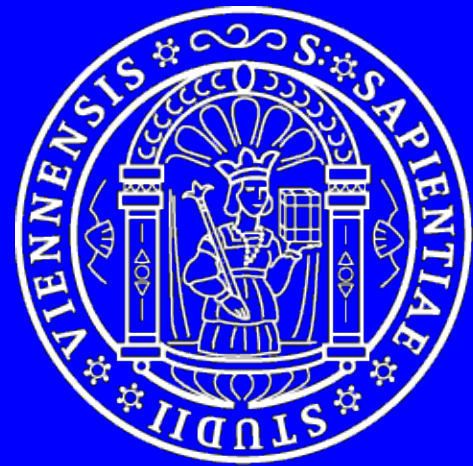
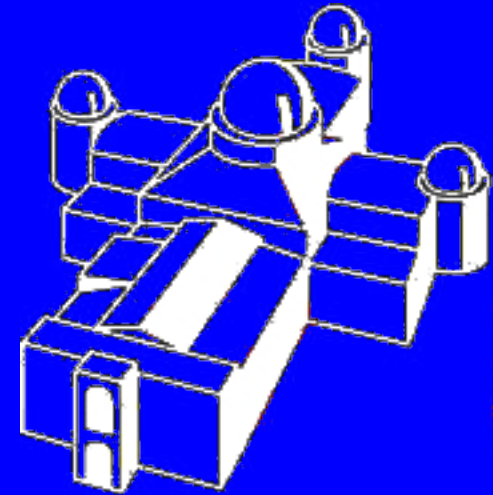


# The co-planarity of satellite galaxies delivered by cold streams



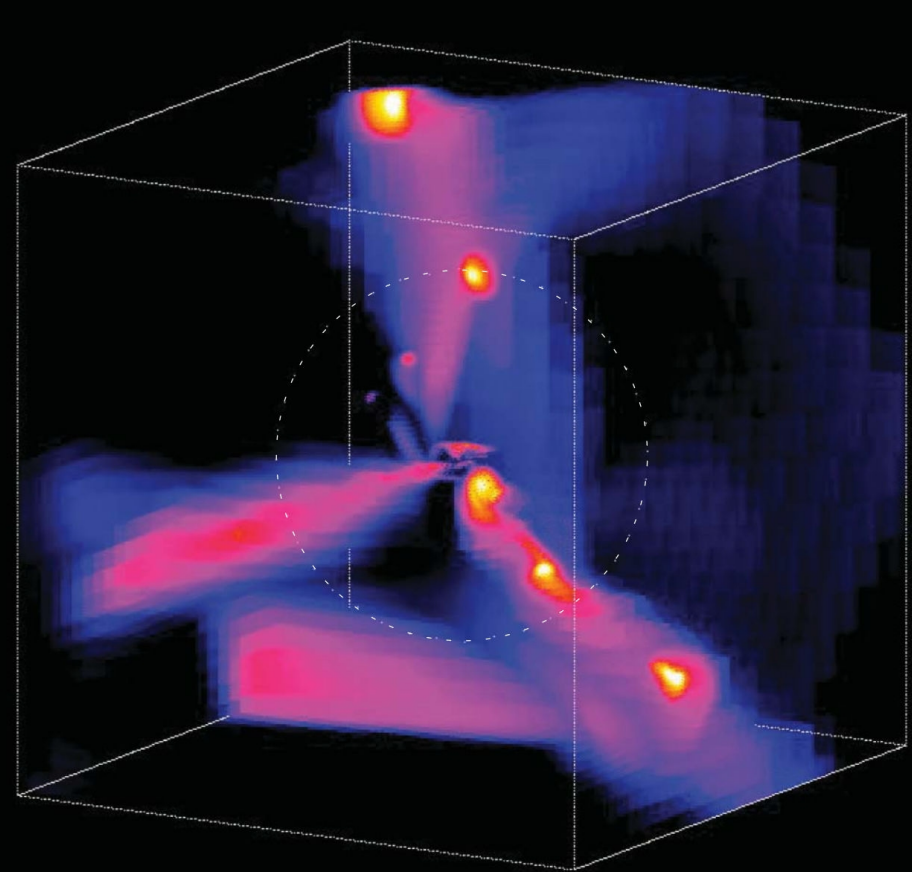
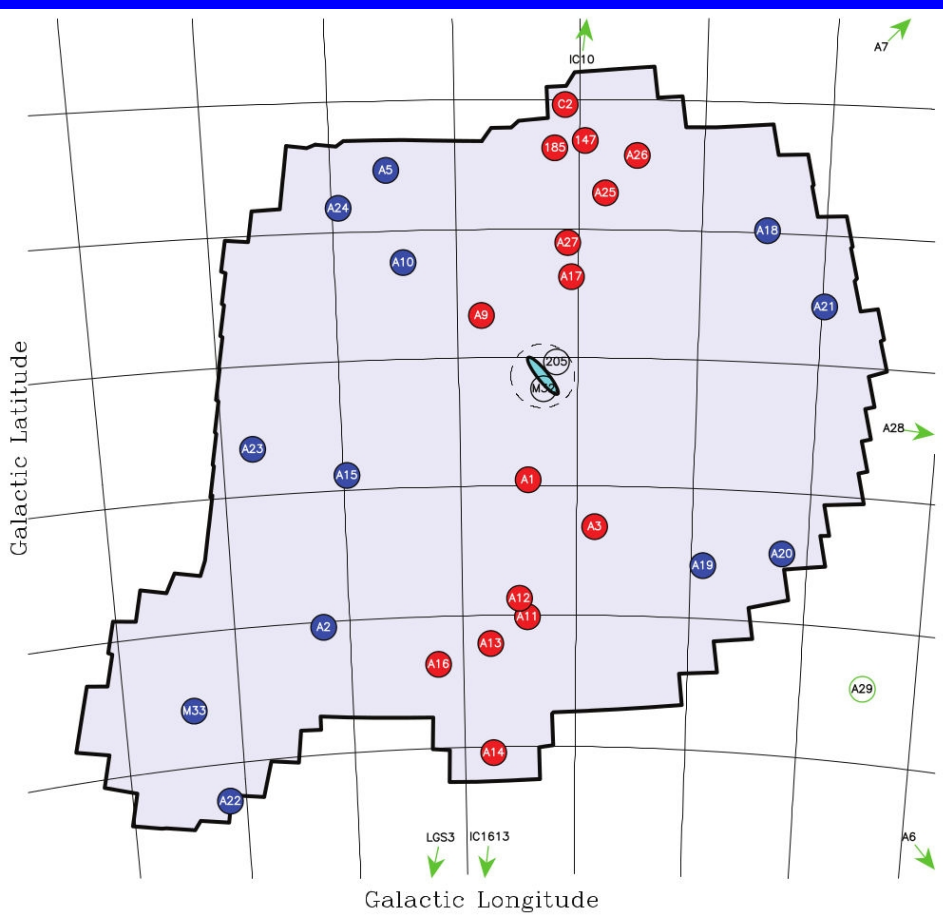
Tobias Goerdt

University of Vienna



Collaborators: Andi Burkert & Daniel Ceverino

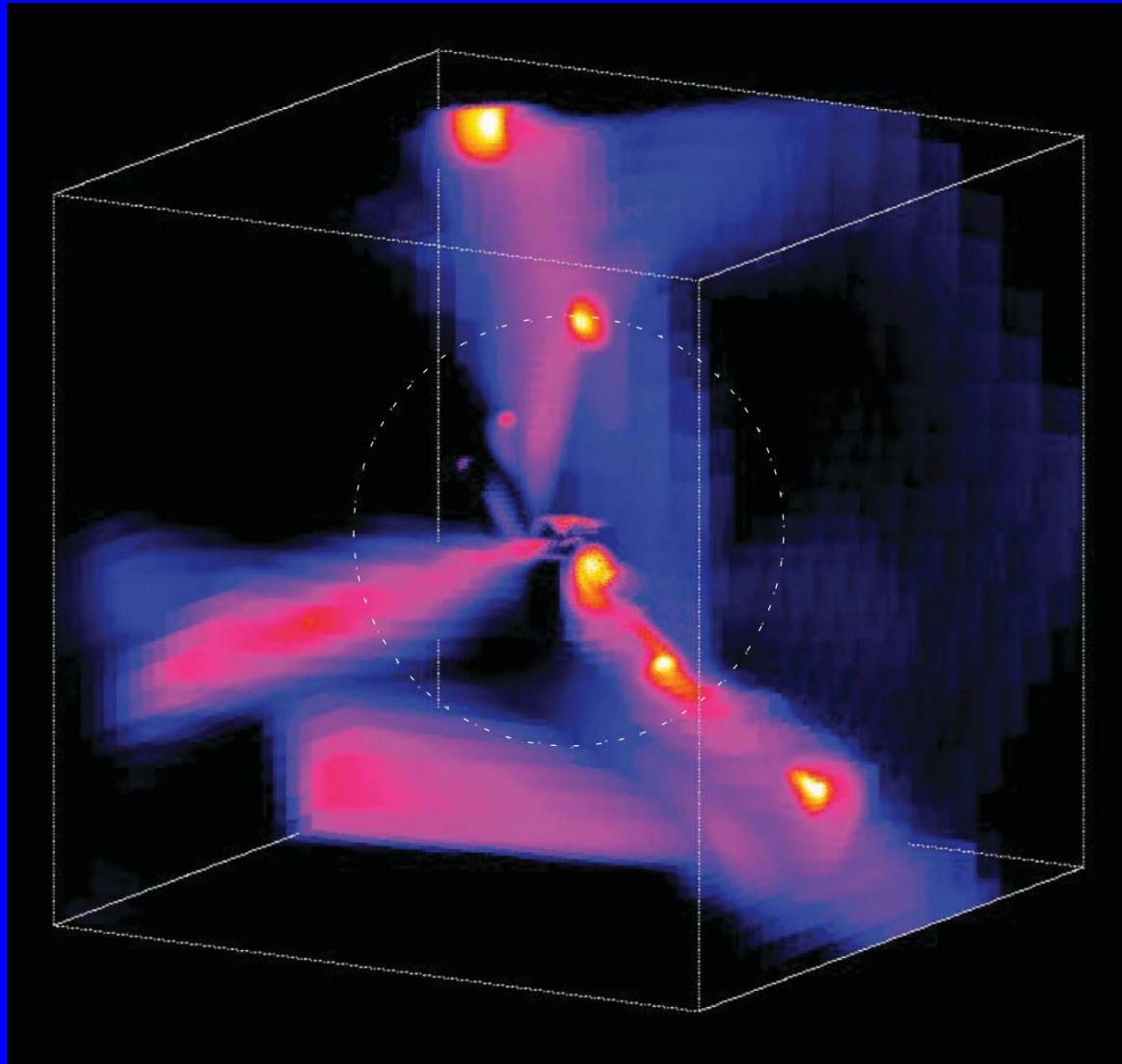
The disk of satellites around the Andromeda galaxy is a natural result of cold stream accretion.



# Plane of satellites:

- 15/27 satellites confined to planar structure
- 13 / 27 co-rotating
- Disk with diameter 400 kpc and rms thickness 12.6 kpc
- Similar flattened structures of satellite systems have been discovered elsewhere (Milky Way, Cen A, M81)

# Cold streams



# Assumptions:

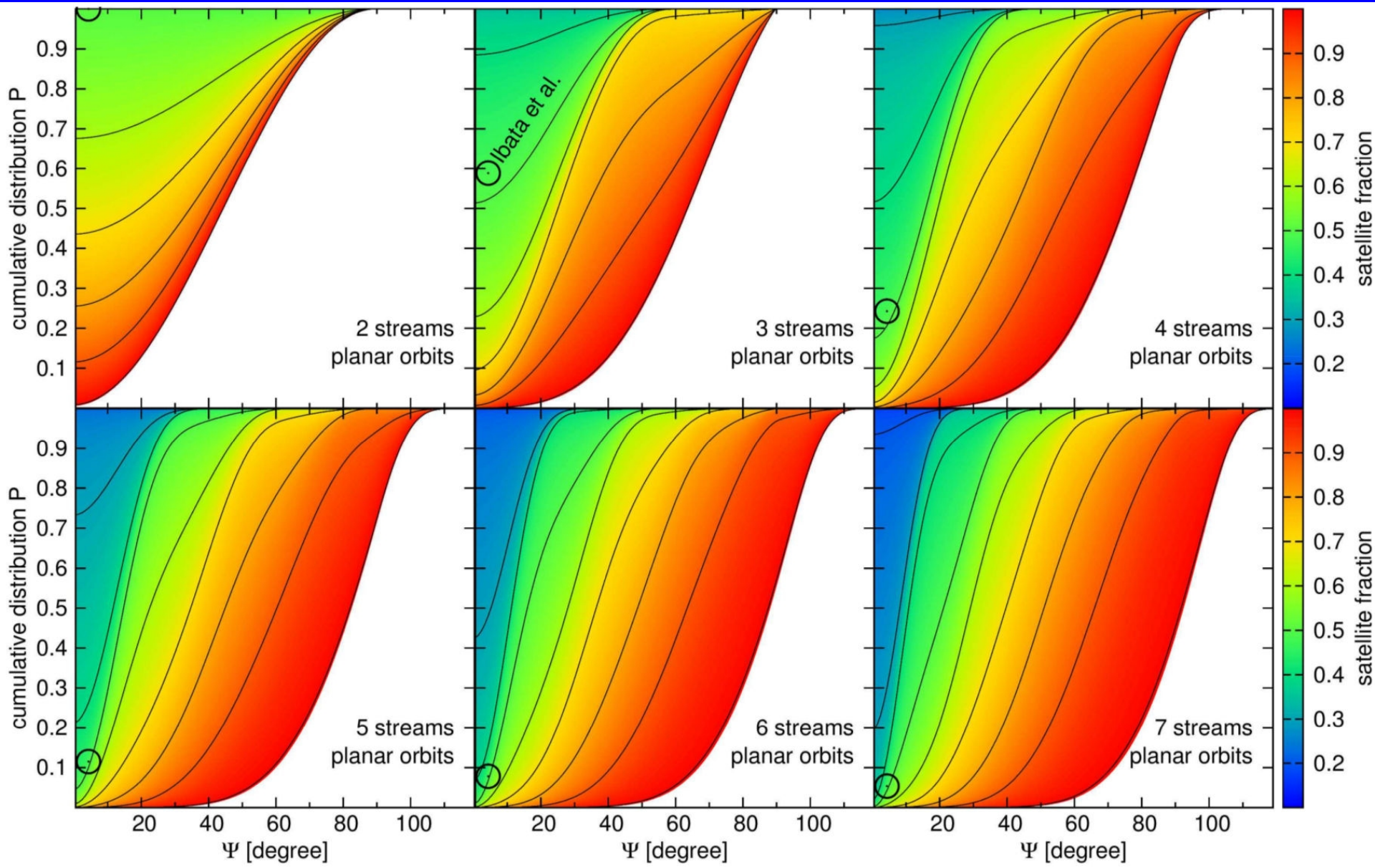
- Majority of incoming subhaloes enter the host halo through cold streams
- Gas clumps end up as satellite galaxies orbiting the central galaxy today
- Host halo has 2 – 7 streams
- The streams are randomly distributed over sky
- Orientation of cold streams does NOT change during period of accretion

# More assumptions:

- Streams are loaded with varying amount of subhaloes
- Streams hit host halo with impact parameter in random direction perpendicular to stream itself
- Subhaloes stay on planar orbits defined by stream and impact parameter

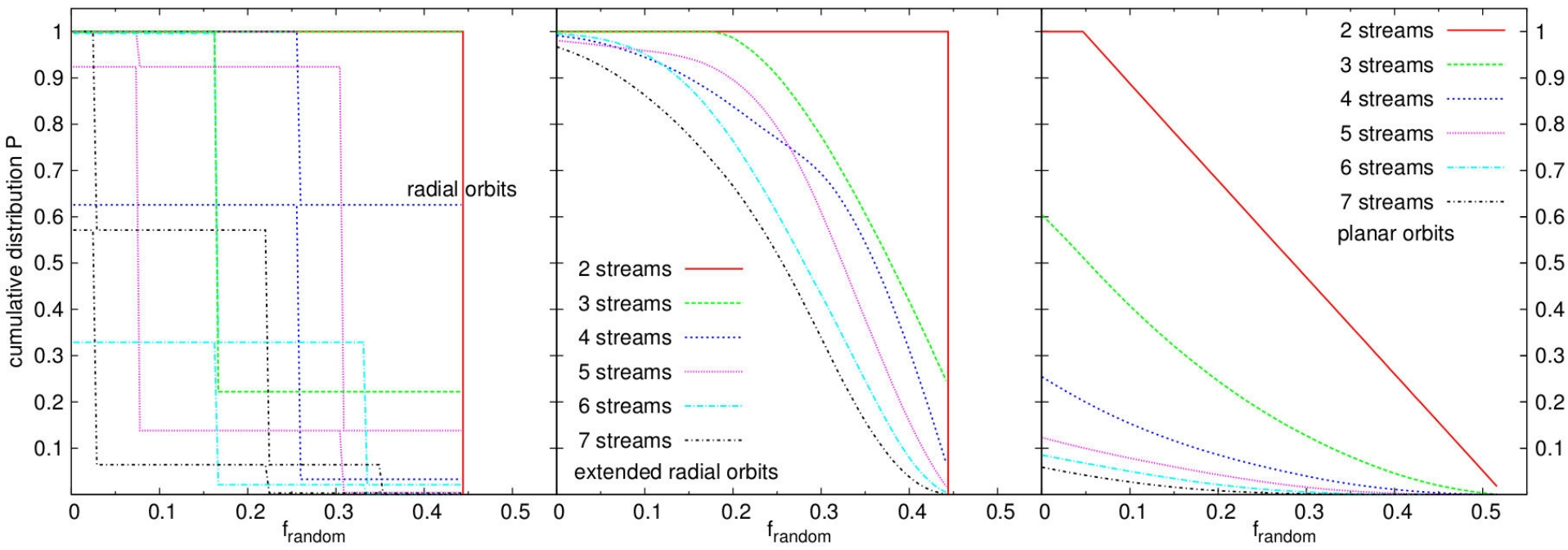


# Probabilities:



# Inflow from random directions

- Satellites from random directions lower the probabilities of required fraction in a thin disk
- Mild inflow ( $\leq 25\%$ ) of satellites from random directions does NOT change our conclusions.





# Summary

- The configuration seen around the Andromeda galaxy is natural result of cold stream accretion.
- Most galaxies having mass of Andromeda should have thin plane of satellites.
- The satellites should naturally distribute themselves into several inclined planes.
- Inflow of satellites from random directions does NOT change conclusions.

Thank you.