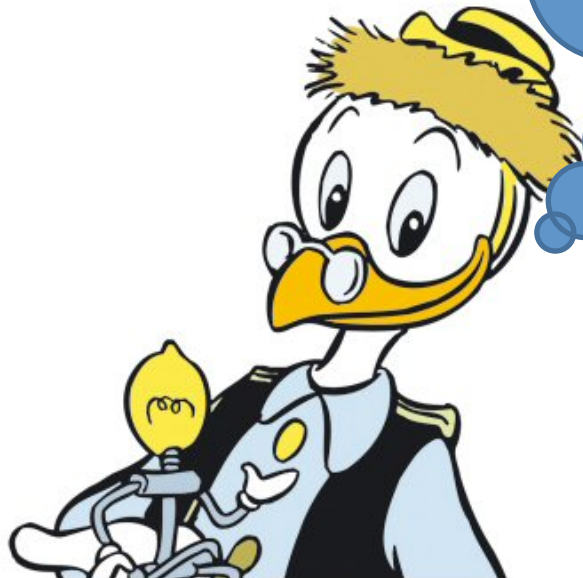


Session 3: AGN Feedback: Theory vs. Observations

- Discussion -

Feedback: Who ordered that?

Colleague X: I can reconstruct galaxy evolution without AGN feedback. Just model the cold flow / smooth accretion properly, add some SN feedback and a good pinch of cosmic rays – done.



Session 3: AGN Feedback: Theory vs. Observations

- Discussion -

Feedback: Who ordered that?

Colleague Y:
Well, perhaps we need it
for suppressing cooling
flows in clusters and
prevent the formation of
too massive galaxies –
but thats it. Radio jets
and BAL winds can do
that.



Session 3: AGN Feedback: Theory vs. Observations

- Discussion -

Feedback: Who ordered that?

Colleague Z:
AGNs exist! The energy
they can release is so
much higher than
needed to quench star
formation – there is no
way the AGN could have
NO influence on the
galaxy



Observations: galactic winds exist!
These **must** be taken into account when
modelling how galaxies are shaped.
Evidence for AGN feedback increasing.

Session 3: AGN Feedback: Theory vs. Observations

- Discussion -

Feedback: Who ordered that?

- Do we need outflows at all?

What are the properties of galactic winds? Statistics and Energetics

- best observation / modeling techniques?

What is the impact of galactic winds?

- How strong is the evidence of large scale (galaxy wide) feedback? Does it have to be large scale?
- do galactic winds quench star formation?
 - what is the best evidence?
 - $t_{\text{depletion}}(\text{wind})$ vs $t_{\text{depletion}}(\text{star formation})$?
- Feedback is always negative? Do we have evidence of positive feedback?

Multi-phase nature: neutral gas, warm ionized gas, hot ionized gas, molecular gas

- can we calibrate? I.e. deduce the properties of all phases if we know one of them?

Does feedback evolve with cosmic time?

- Molecular outflows at redshifts >0.3 ?

Why do we see strong molecular outflows only in ULIRGs (or do we)?

- Is this the case only locally?

Who is the main driver of galactic winds? Starburst vs. AGN?

- kinematic signatures:

- when is v_{outflow} too large for SB? >1000 km/s? >2000 km/s? Trends with L_{AGN} , SFR, ...

- dynamical signatures

- when is $\eta = dM/dt / \text{SFR}$ too large for SB winds? 2 (M82 / N253)? >5 ? >10 ?
- when is $\tau = (dp/dt) / (L_{\text{AGN}}/c)$ too large for AGN winds? 5? 10? 20?!

- other diagnostics ?

- Is there any case where the AGN is driving the (molecular) outflow without doubt?

How is the gas driven? Which is the mechanism to transport the energy from the nucleus to the galaxy disks?

- acceleration processes

- How can we differentiate between: thermal pressure, radiation pressure on gas-dust, cosmic-ray pressure, jet ram pressure?

- survival time scale to cloud erosion - Why are molecules not destroyed in the outflow (or are they)?

Can we learn more about the physical conditions in outflows (densities, temperatures, ...)?

- PDR/XDR/photoion. modeling of outflows ?
- What is (are) the conversion factor(s) to H_2 ?