Galactic Winds & Radio Galaxies: A New Hint of the Starburst - AGN Connection?

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The observations

- High redshift radio galaxies show huge emission line haloes
- The smaller ones show blue-shifted self absorption (Z > 2)

![Ly α halo of a big radio galaxy with radio contours (>100 kpc, Reuland et al. 2003)](image1)

![Ly α spectrum for a small source (Wilman et al. 2004)](image2)

The so far suggested explanations

- Ly a forest: no, too frequent (van Ojik et al. 1997)
- Blended smaller absorbers: yes some, but some present in highest resolution spectroscopy (Wilman et al. 2004)
- Normal narrow line clouds in ionisation cone: no, wrong kinematics & metallicities (Binette et al. 2000)
- Extended low density shell: no, pressure too low for outflow (Krause 2005)
- Jet’s radiative bow shock: may be, but high external density required (Krause 2002)

This model

Triggered possibly by a starburst, a galactic wind with radiative bow shock produces a dense shell like the one observed by Dawson et al. 2002 (passive galaxy). Then the jet starts, and is absorbed while small. While the beam struggles to pierce the shell, the cocoon fills the wind bubble, and accelerates the shell, thereby destroying it via the Rayleigh-Taylor instability

The simulations

Initiate a galactic wind by energy and mass input. After 80 Myr a spherical bubble with a dense shell has formed. Now, a very light jet starts and propagates for 20 Myr. Simulations with hydrodynamics code Nirvana on NEC SX-5 and NEC SX-6 @ High Performance Computing Center Stuttgart (Germany).

Results & Predictions

The simulated absorption shows the required (lack of) column density in the early (late) phase at the right velocities: model confirmed. This points to a starburst – AGN connection: about 100 Myr after the starburst starts causing a wind, the black hole starts the jet production. The round bubbles should be visible in good radio maps. The radio galaxies are in the centres of big proto-clusters of galaxies. The radiative shock requires a sound speed in the cluster gas below a few hundred km/s. Therefore the typical temperature in big clusters at redshifts 2-4 should be one million Kelvin, i.e. an order of magnitude below lower redshift ones. This is in agreement with the hierarchical galaxy formation model.