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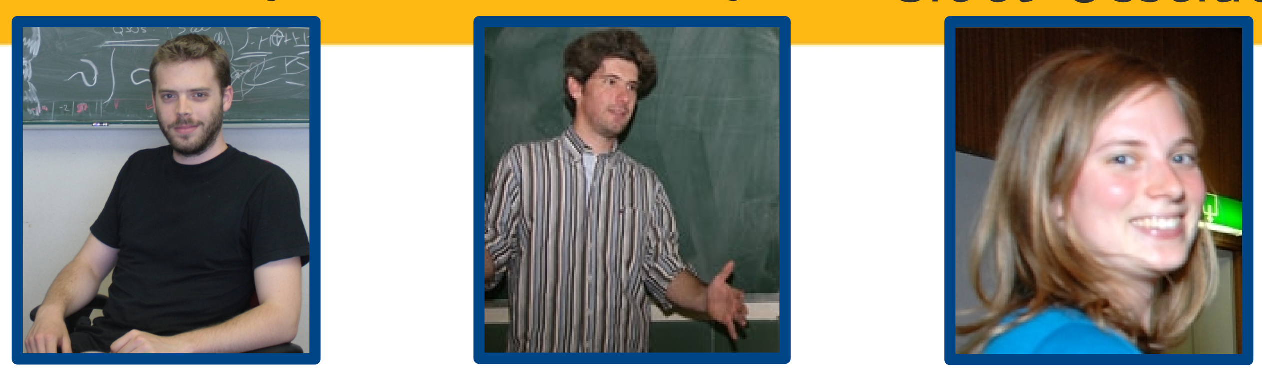
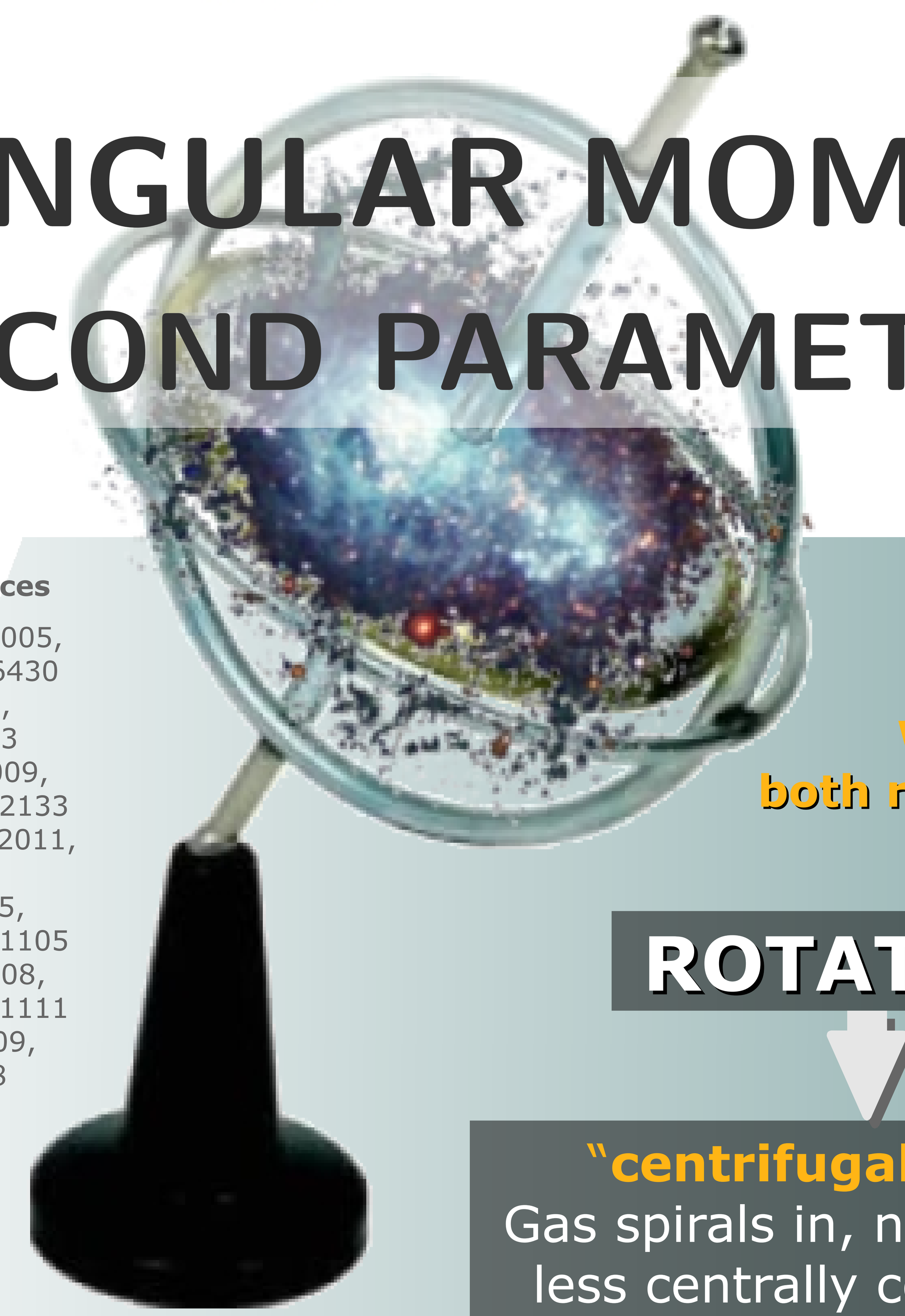


ANGULAR MOMENTUM AS A SECOND PARAMETER IN DWARF GALAXY EVOLUTION

Schroyen et al. 2011 (MNRAS)



References

Dolphin et al. 2005, astro-ph/0506430
Kim et al. 2003, ApJS, 148, 473
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"Centrifugal Barrier Mechanism"

We have run a large suite of Nbody-SPH simulations of isolated, flat dwarf galaxies, both rotating and non-rotating, based on the spherical DG models of Valcke et al. (2008).

The main goal is to investigate possible mechanisms to explain the observed dichotomy in radial stellar metallicity profiles of dwarf galaxies: dwarf irregulars (dIrr) and flat, rotating dwarf ellipticals (dE) generally possess flat metallicity profiles, while rounder and non-rotating dEs show strong negative metallicity gradients (e.g. **Koleva et al. 2009**).

These simulations show that rotation is key to reproducing the observed characteristics of dwarf galaxies. We therefore extended our research, investigating the effects rotation has on the global behaviour of dwarf galaxies in general. We propose the **"centrifugal barrier mechanism"**, presented here, which ties all effects together and is able to explain the observations.

All simulations were performed with a modified Gadget2 code, which includes star formation and feedback (Gadget2: Springel et al. 2005)

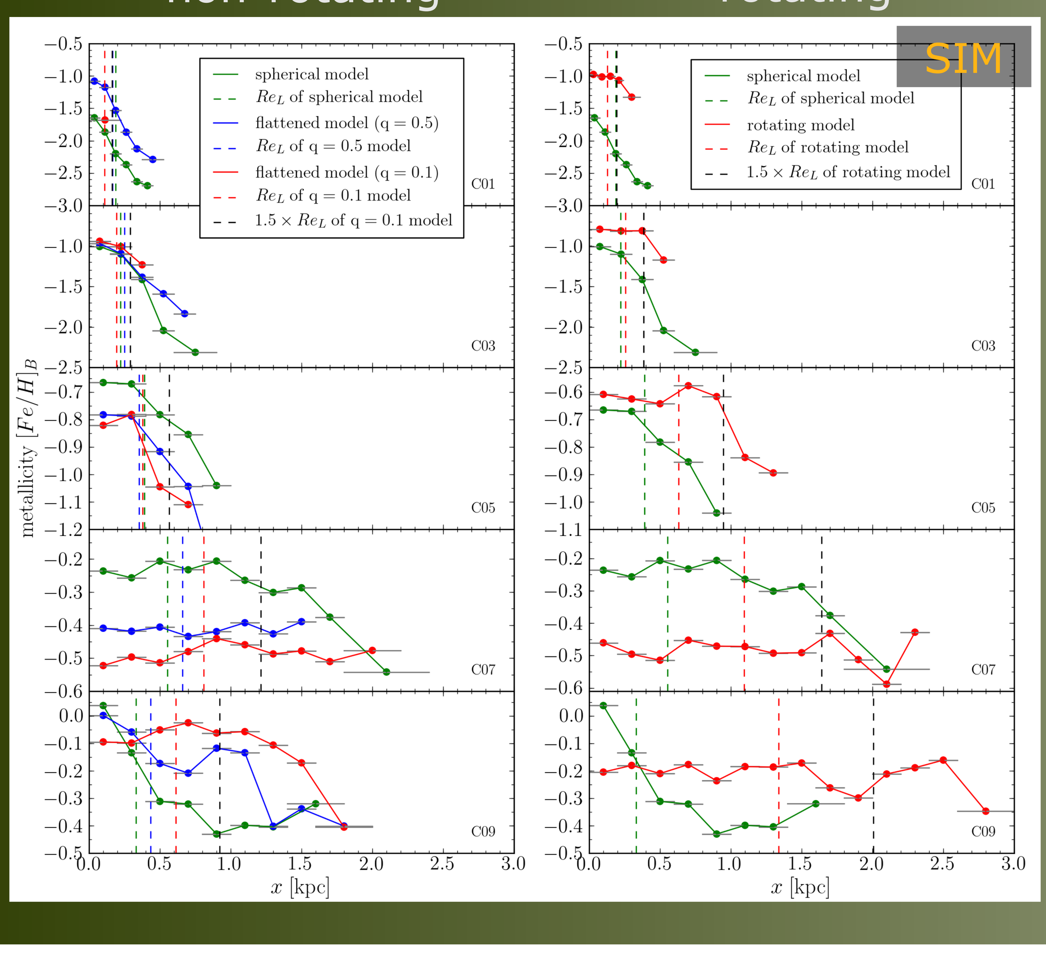
ROTATION

"centrifugal barrier"
Gas spirals in, no direct infall
less centrally concentrated

SF smeared out in space
occurs galaxy-wide

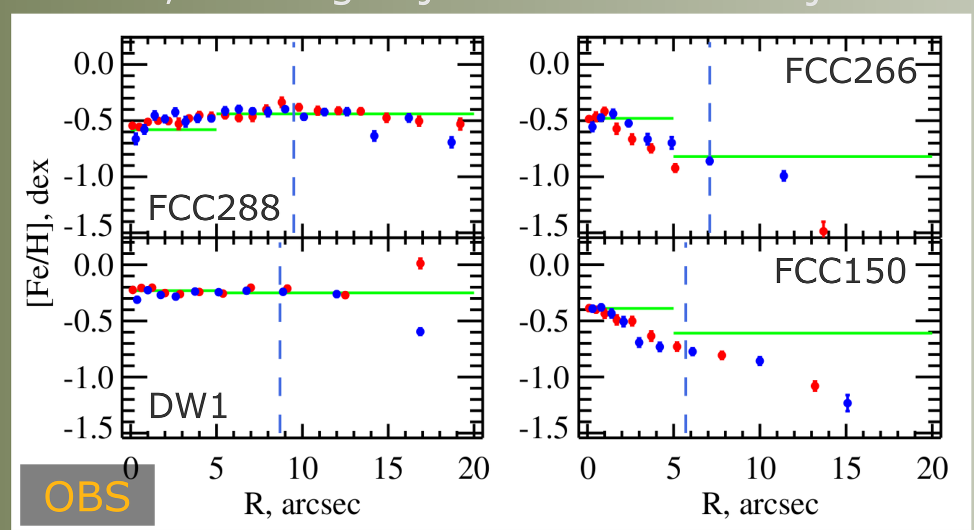
Spatially homogeneous stellar populations
Flat metallicity profiles

non-rotating   rotating



Non-rotating dwarf galaxy models all generally show negative metallicity gradients, irrespective of their geometry/flattening. All rotating dwarf galaxy models on the other hand show flat metallicity profiles out to at least 1.5 x Re. Flat metallicity profiles therefore are a consequence of the **rotational state** of the galaxy, and not its **geometry**, as is claimed by the previously suggested "fountain mechanism"

Flat, rotating objects   Round objects

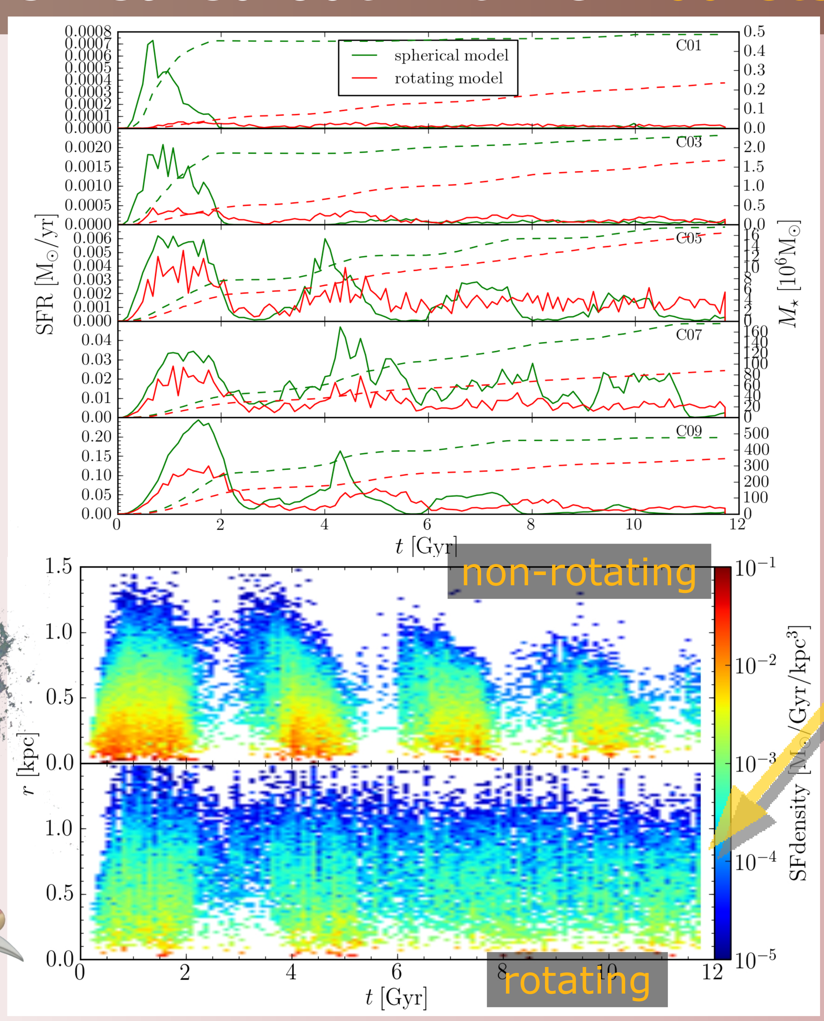


Images from Koleva et al (2009)

Feedback smeared out

Collective SN energy smeared out
influence more local, less global

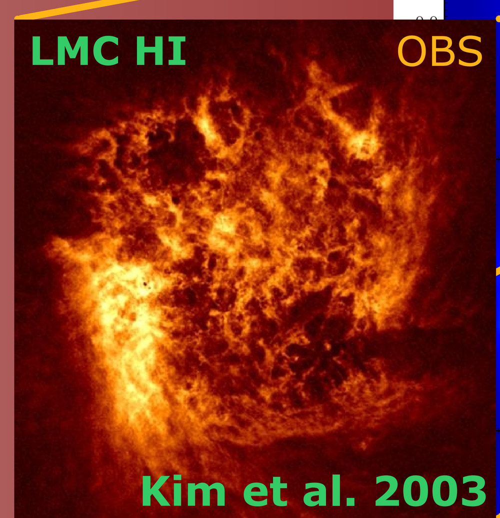
No complete shutdown of SF
Criteria only locally not satisfied (holes)
SF smeared out in time - bursts cancelled



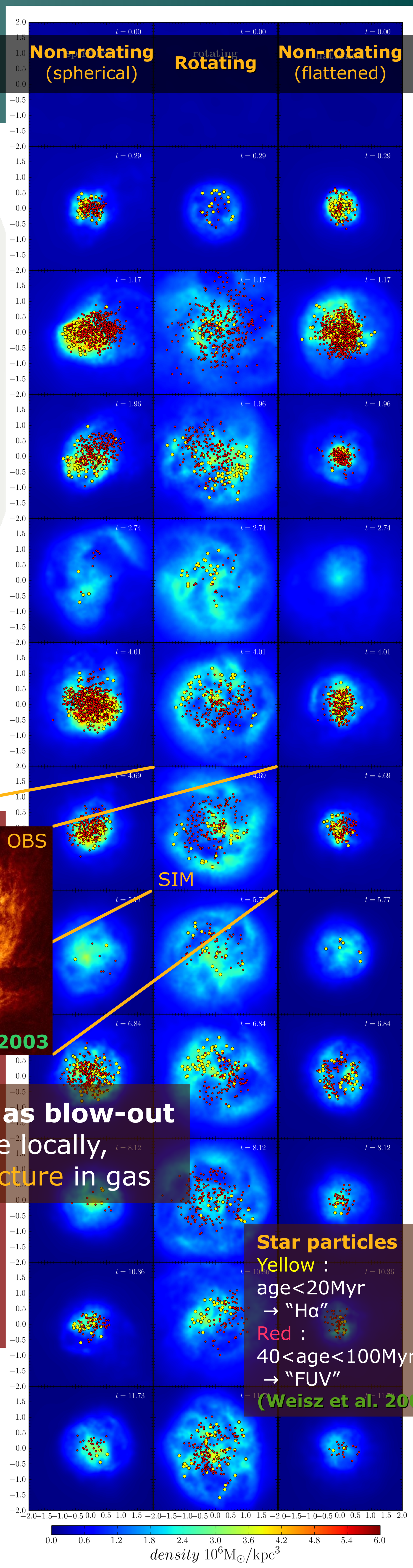
The star formation histories (SFH) of non-rotating models show strong SF bursts of a few Gyr, the so-called **SF-"breathing"**, seperated by periods without any SF at all. The rotating models on the other hand all clearly show a less varying, more **continuous SFH** : less large-scale oscillation, some SF always present in the galaxy. This corresponds to the **observed SFHs of dIrrs (Dolphin et al. 2005)**.

SF smeared out in **space and time**

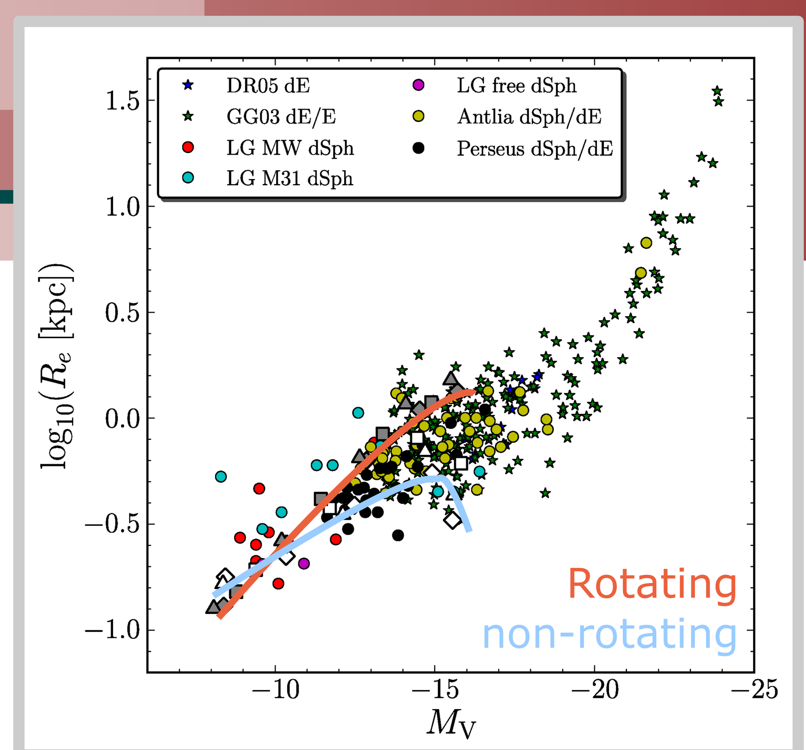
Rotation has a pronounced influence on the global **photometric and kinematical scaling relations**, possibly explaining the observed **widths**.

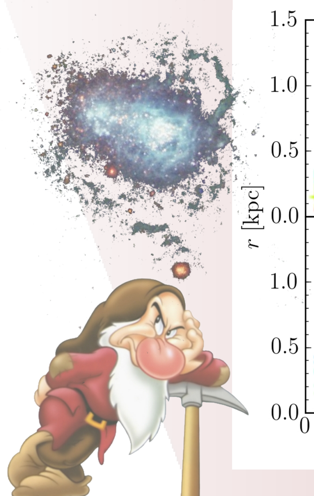


No collective gas blow-out
SN combine locally,
blow hole structure in gas



Star particles
Yellow : age<20Myr → "Hα"
Red : 40<age<100Myr → "FUV"
(Weisz et al. 2009)





Conclusions

ROTATION = important factor in DG behavior
- Significant influence on evolution and appearance
- Differentiates SF modes: centralized/bursty – extended/continuous
- Necessary to qualitatively reproduce typical dIrr characteristics (spatially extended SF, continuous SFH, chemical homogeneity, ISM hole structure)

➡ Angular moment is a **SECOND PARAMETER**