Triggered Star Formation in a Turbulent ISM
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Starbursts in isolated galaxies: burst modes in coupled star-gas systems

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We studied the stability properties of isolated star forming dwarf galaxies with the aim to identify star burst modes. The impact of the stellar birth function (parametrization, IMF), the stellar feedback and the ISM model on the galactic star formation history was investigated. We focussed especially on dynamically driven star bursts induced by stellar feedback. We applied a one-zone model for a star-gas system coupled by both mass and energy transfer. Additionally, we extended the classical closed box network for **active dynamical evolution** (Theis 2004). This allows for a simple, but consistent description of the coupling between the dynamical state of a galaxy and its internal properties like star formation activity or the thermal state of the interstellar medium.

Our calculations revealed three types of repetitive star burst modes in isolated galaxies:

• mode A: initial transitory oscillations following the dynamical state: if the energy dissipation in the gas is fast, the gas temperature remains close to the equilibrium temperature for the actual density. In that case the star formation rate follows mainly the decaying virial oscillations.

• mode B: recurrent star bursts after long quiescent periods: if the energy dissipation in the gas is slow (occurs when the dissipational timescale is of the order of or longer than the dynamical time, e.g. in case of dissipation by clump-clump collisions), active periods are separated by long quiescent periods. The quiescent periods are a combination of the dynamical and the dissipative timescales. Such burst modes occur only in a small mass range. They become more pronounced in strongly dark matter dominated systems.

• mode C: cooling function induced instability: a negative temperature gradient of the cooling function leads to an oscillatory behaviour. Proper conditions are only met for low gas densities and low metallicities.

Moreover, we found that a negative thermal feedback in the star formation description leads to a destabilization, i.e. oscillatory behaviour of the system. This is in contrast with the standard closed-box models neglecting the dynamical description.

Finally, we investigated the impact of a time-dependent IMF. As an example we adopted a Weidner-Kroupa-type IMF which couples the overall star formation rate to the effective upper mass limit of the IMF, by this influencing the stellar feedback. We found that such an IMF variation has only a marginal influence on the overall star formation activity due to very efficient self-regulation in the system.

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References

Theis, Ch. 2005, in: S. Hüttemeister *et al.* (eds.), *The Evolution of Starbursts* (AIP Conf. Proc.), Vol. 783, p. 57