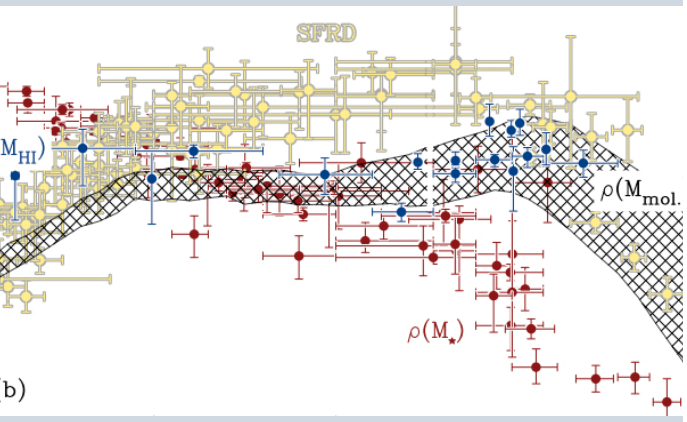
Colloquium

SFB 956

Conditions and Impact of Star Formation

17.11.2014
Monday 4:00 pm

Max-Planck-Institut für Radioastronomie (MPIfR)
Auditorium 0.02
Auf dem Hügel 69 | 53121 Bonn



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Starbursts, normal galaxies and the molecular gas history of the universe

Observations during the past several years revealed the existence of a so-called „main sequence" for star-forming galaxies out to high redshift. While the majority of star-forming galaxies obeys this fairly tight relation between star formation rate (SFR) and stellar mass, a smaller subset of the population - referred to as „starbursts" - displays specific star-formation rates and star formation efficiencies (SFE) that can exceed those of "normal" (main-sequence) galaxies by an order of magnitude. But even though starbursts are among the most luminous and most rapidly growing objects in the Universe, the fact that they are relatively rare implies that most of the stars in present-day galaxies were formed in normal galaxies on the main sequence.

The study of the molecular gas which fuels the star formation in main-sequence galaxies near and far is thus a prominent area of current extragalactic astronomy. The interpretation of the CO-line emission from the roughly 150 normal star-forming galaxies detected to date at $z > 0$ suggests that there is a high degree of homogeneity between low- and high-redshift main-sequence galaxies in terms of their molecular gas properties. I will show that the variations of SFE and gas fraction about the characteristic value of a "typical" main sequence galaxy do not change over the range $z < 3$. For starbursts, the change in SFE scales supralinearly with the SFR enhancement, as expected for merging events, implying a continuous distribution of galaxies in the Schmidt-Kennicutt plane that is not strictly bimodal, but nevertheless more clearly separated into a locus for starbursts and normal galaxies than their relative distribution in the space of SFR and stellar mass.

I will discuss how we can exploit these scaling relations to infer the molecular gas properties (e.g. H_2 mass functions and CO-luminosity functions) of the large samples of distant star-forming galaxies that await detection in upcoming blind sub-mm surveys with ALMA and the JVLA. I will also apply our formalism for distinguishing between starbursts and normal galaxies to constrain the fraction of the total molecular gas content of the Universe that fuels burst-like and secular star-formation activity, respectively.