

## Preface

Chemodynamical evolutionary models were invented to provide a global dynamical description of the interplay between the major physical components of galaxies: in a gravitational potential essentially dominated by dark matter, stars structure the multi-phase ISM through radiation, winds and supernovae and enrich it in heavy elements. From a cosmological perspective, these models should begin with the formation of the first structures. Heavy elements formed by the very first generation of stars pollute the early IGM, thus allowing for more efficient radiative cooling during the formation of the next astrophysical objects: galaxies are born.

Chemodynamical models yield quantitative predictions for the observable consequences of the violent physical mechanisms that occur within galaxies. Perhaps the most remarkable one is that the ISM self-regulates which implies that the star formation rate in galaxies is ultimately controlled by feedback processes. In other words, they argue that observations over a wide range of wavelengths should be linked: X-ray emission of the relatively low density supernova heated gas that permeates the entire ISM, impacts on the far infrared cooling emission lines present in the densest molecular cores.

Forthcoming instruments such as MUSE, JWST, ALMA and SKA will shed light on the high redshift Universe population of proto-galaxies whereas XMM, Chandra, GALEX and Spitzer are now probing galaxies panchromatically at lower redshifts. Current computational power then allows us to numerically explore the first ages of structure formation. It also makes it possible to follow in greater detail the chemodynamics of individual objects. As a consequence, we lie at a crossroad between two epochs. The intent of the CRAL Conference entitled “Chemodynamics: from the first stars to local galaxies” was to give the opportunity to review where chemodynamical models stand.

The CRAL (Centre for Astrophysical Research of Lyon) is a Joint Research Unit (UMR 5574) of the University of Lyon 1 Claude Bernard (UCBL), the École Normale Supérieure de Lyon (ENS-L), and the Centre National de la Recherche Scientifique (CNRS). Its research activities are carried out in two sites: the Observatory located in Saint-Genis Laval, and the ENS-L in Lyon, in the Gerland district.

The CRAL gathers expertise in many fields of astrophysics and instrumentation (cosmology, nearby galaxies, stellar interiors, compact objects, extrasolar planets, 3D spectroscopy, adaptive optics). The CRAL leads the consortium that will provide MUSE, a second generation integral-field spectrograph for the VLT. It also participates to several other international or national projects, like NIRSpec a near-infrared spectrograph for the JWST, and HORIZON, a high-performance numerical simulation project for cosmology and galaxy formation. At the end of 2004, it was decided to organize every two years a series of International Conferences in Lyon. These are the “CRAL Conference Series”.

The 2006 Conference was the first event in the Series. It was held in Lyon from the 10<sup>th</sup> to 14<sup>th</sup> of July. The topic was “Chemodynamics: from the first stars to local galaxies”. The success of the conference hinged on the efforts of many people. The Local Organizing Committee was led by Eric Emsellem and included Nicolas Champavert, H el ene Courtois, Julien Devriendt, Jean-Fran ois Gonzalez, G erard Massacrier, Jimmy Paillet and Herv e Wozniak. Their infallible enthusiasm for preparing this event is undoubtedly a great part of the success.

The Scientific Organizing Committee consisted of Eline Tolstoy, who kindly accepted to chair it, Greg Bryan, Fran oise Combes, Andrea Ferrara, Gerhard Hensler, Max Pettini and Keiichi Wada. Many thanks for their interest in the conference. Their role was crucial for the quality of the conference.

Considerable help was provided by the CRAL administration staff (Nadine Bernier, Nadia Hassiri, Sylvie Pradel, Mich ele Villard), the technical staff (Jean-Pierre Dubois), and students (Cl ementine Bechet, Razvan-Stefan Ciobanu, Ga elle Dumas, Jaime Forero, Jos e Gallardo, Xavier Gnata, Aur elien Jarno, Guillaume Rigaudier, Ferreol Soulez, Dylan Tweed), both during the preparation phase and during the meeting. Although the audience was somewhat perturbed by the temperature of the lecture room, we must remember the high availability and kindness of our hosts on the Gerland campus, Mme Bouilhol and Mr. Monterrat, including on the National Day.

The venue of this conference was made possible through a number of sponsoring organizations: the D epartement Sciences de l’Univers of CNRS, the University of Lyon 1, the  cole Normale Sup erieure of Lyon, the National Programmes “Galaxies”, “Cosmology” and “Stellar Physics” of the Institut National des Sciences de l’Univers. The Conseil R egional Rh one-Alpes and Conseil G en eral du Rh one are acknowledged for their financial contribution to the publication of these proceedings.

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