

## Baryons in Dark Matter Halos

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## Preface

The existence of Dark Matter (DM) has been long known. The first cognitions came from motions of galaxies in clusters and by the kinematics of individual galaxies and were followed by systematic investigations, primarily via galaxy rotation curves. Since the mid 90's, observations can be confronted with models defined in specific galaxy formation scenarios, in particular with the output of simulations performed in the framework of  $\Lambda$ Cold Dark Matter (CDM). The great success of these models is that they nicely reproduce the large-scale structure, while they - maybe not surprisingly - seem to fail to be equally successful in describing the evolution of the universe on smaller, i.e. cluster and galaxy scales.

These developments were paralleled by breathtaking advancements in cosmology. Since the precision measurement of the spectrum of the cosmic microwave background (CMB) with COBE, subsequent experiments devoted to the CMB anisotropy (Boomerang, WMAP) have led to what is called 'precision cosmology'. This implies that we are in the position of validating (numerical) models to a high degree. At the same time, we are witnessing amazing developments in observational astronomy, which allow to explore the universe back into the epoch of re-ionization, thereby subjecting models to further critical and crucial tests, the last steps expected to be taken in the near future. All of this does not mean that we may consider most of the riddles solved. In fact, it must be a worry to any astrophysicist that both, DM and Dark Energy remain nothing but hypotheses as long as no particle has been detected in lab experiments yet. Nearly ten years of critical validation of CDM models have, alongside with a lot of success, resulted in what has been coined the "CDM crisis", i.e. the failure of theory to explain certain observational evidences such as the mass spectrum of satellites around galaxies, and the (partial) absence of cusps in the dense inner part of galaxy halos. Another outcome is the realization that the hierarchical picture of the evolution of dark matter halos does not imply a similar hierarchy in the baryonic cores they grow.

The above rationale has been the driving force of the conference Baryons in Dark Matter Halos, organized by the Bochum /Bonn graduate research school "Galaxy Groups as Laboratories of Baryonic and Dark Matter" and SISSA, taken place in Novigrad/Cittanova 5-9 Oct 2004. This event has brought together experts from the whole world in the relevant fields, with the aim to make a critical assessment of what has been achieved and to identify the problems that we are faced with and the future directions of research leading to further progress in our understanding of structure formation and evolution of galaxies.

The [Proceedings of the Conference](http://pos.sissa.it) are published on-line by PoS (<http://pos.sissa.it>) which is a new versatile, online proceedings and lecture notes publication service launched by SISSA, Trieste.

**R.J. Dettmar, U. Klein, P. Salucci**

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