Foreword

My scientific career has developed so far at the borders between particle physics, cosmology and astrophysics, in what is commonly identified as the field of **astroparticle physics**.

The **'flow' of my research** can be generically captured by the following definitions: models with extra space dimensions for particle physics (2001) → models with neutrinos in extra-dimensions (2002) → sterile neutrinos and neutrino cosmology (2003-2006) → neutrinos produced from Dark Matter annihilations (2005) → constructions of Dark Matter (DM) models (2006-2008) → phenomenology of indirect detection of DM (2008-2014) → exploration of alternative models for DM production (2012) → phenomenology of DM direct detection and collider detection (2013-2014).

Hence, what is arguably the dominant core interest of my recent activity right now is the exploration of **DM Indirect Detection (ID) methods**. These consists in using cosmic rays (gamma rays, charged particles and neutrinos), produced by the annihilations or decays of DM particles in our galactic halo and beyond, in order to reveal the existence (and eventually study the properties) of the Dark Matter itself.

In this context, I have in particular put a special attention into the ID phenomenology of the DM models recently proposed in the wake of the excitement for 'anomalies' in the data, such as the PAMELA positron excess, the FERMI gamma-ray line, the GeV gamma-ray Galactic Center excess etc.

This *mémoire* is divided in two parts. In **Part A** I briefly present myself and my scientific activities up to now (october 2014). In **Part B** I present a selection of results in DM Indirect Detection. The logical structure of Part B, in turn, is twofold: 1) it presents the basic concepts and formulæ that are used in the field, in the form of a 'matter of fact', (hopefully) useful collection of tools; 2) it presents briefly the status of the searches and sketch the research directions that have stemmed from them.