Direction des Sciences de la Matière
IRFU
Service d'Astrophysique

Soutenance de thèse du Service d'Astrophysique

THE MULTI-PHASE INTERSTELLAR MEDIUM OF STAR-FORMING DWARF GALAXIES

Diane CORMIER

SAp

Lundi 26 novembre 2012 – 14h00

Salle Galilée – bât 713

Low metallicity environments, such as star-forming dwarf galaxies, the Magellanic Clouds, and well-resolved Local Group dwarf galaxies are ideal laboratories to study the early stages of galaxy evolution, and address fundamental questions such as: What are the roles of the different interstellar medium (ISM) phases in the integrated view of galaxies and how do parameters such as metallicity and star formation activity affect this? How can the far-infrared (FIR) fine structure lines be used effectively as high-redshift star formation tracers?

My thesis has focused on the study of the gas properties of star-forming dwarf galaxies, investigating the role of the most important MIR-to-submm tracers from the multi-phase ISM. I will show how metallicity influences the ISM structure and the molecular cloud morphology, and what the resulting observed properties are.

I will present FIR spectroscopy results on the ionized and neutral atomic gas from the Herschel Dwarf Galaxy Survey, as well as new CO data that we obtained to characterize the molecular gas. We find that the FIR lines are bright, especially the [OIII]88mu and [CII]157mu lines, and are enhanced on galaxy-wide scales. On the contrary CO is faint and, at low metallicity, does not trace well the molecular reservoir that fuels star formation. Observations are interpreted with radiative transfer models with a multiphase approach to determine the physical conditions of the gas.

This work results in a vivid picture for the ISM of dwarf galaxies described by clumpy photodissociation regions bathing in extended diffuse gas. In particular, the filling fraction of diffuse ionized gas is larger than in normal galaxies, and the fraction of molecular gas not seen by CO might be important. More progress on the ISM structure characterization and calibration of star formation at low metallicity will be possible by resolving the source distribution, with, e.g., ALMA.

Commissariat à l'énergie atomique
Centre de Saclay - CEA/DSM/IRFU/SAp - bât. 709 - 91191 GIF SUR YVETTE CEDEX - FRANCE
Tél : 33 - 1 69 08 78 27 - Fax : 33 - 1 69 08 65 77