



Canadian Association  
of Physicists

Association canadienne  
des physiciens et physiciennes

Contribution ID: 22

Type: **Invited Speaker / Conférencier(ère) invité(e)**

## How was Dark Matter produced in the early universe? A Study of fermionic Dark Matter with a $Z'$ portal

*Monday 8 June 2020 17:00 (15 minutes)*

We study a model of fermionic dark matter (DM) interacting with the standard model (SM) through a  $Z'$  mediator, the gauge boson of a  $U(1)$  extension to the SM symmetry group, to understand the mechanism responsible for the DM relic abundance in different regions of parameter space. We compare two different mechanisms for the DM production in the early universe, freeze-out and freeze-in. For production through freeze-out, DM particles were in thermal equilibrium with the cosmic plasma until the expansion of the universe dominated over the frequency of interactions when the DM decoupled from the thermal bath. For freeze-in, DM was never in thermal equilibrium with the visible sector since it couples so weakly to it. In this work we take into account all processes that change the amount of DM (annihilation and production). The boundary between different production regimes is explored by considering the parameter space of this model namely the DM candidate mass, mediator mass, and DM couplings. Properly taking into account the boundary region between freeze-in and freeze-out could have implications for DM searches.

**Authors:** Dr COSME, Catarina (Carleton University); Dr DUTRA, Maíra (Carleton University); Dr GODFREY, Stephen (Carleton University); Ms GRAY, Taylor (Carleton University)

**Presenter:** Ms GRAY, Taylor (Carleton University)

**Session Classification:** PPD-2 : Dark Matter | Matière sombre

**Track Classification:** Particle Physics / Physique des particules (PPD)