

Constraining multi-Higgs dark matter

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bSM model building activity

General perspective:

- Building and testing models beyond the Standard Model is the most active field in particle physics nowadays;
- One particularly intensive direction — models with non-minimal Higgs sector;
- More Higgses → more fun! In the SM, one poor Higgs is responsible for everything it can do; non-minimal Higgs sector can do much more.

Scalar DM candidates

One particular thing non-minimal Higgs sectors can do: natural **dark matter candidates** in models with various symmetries.

Symmetry protects some Higgses against decay \rightarrow stable Higgses = DM.

Simple versions of such models have been studied in detail, and now many people move to more elaborate versions with **rich scalar dark sector**.

Main goal

Dark sectors can well be very rich and complicated.
It is time to **systematically explore various options!**

Specific tasks

- Take multi-Higgs models with specific symmetries (the list is known). Find scalar dark matter candidates. Calculate their masses and interactions — **work underway**;
- Find ways to distinguish models with differently interacting multi-Higgs dark sectors — **just started**;
- Implement these models in computer packages and test them against experimental results — **will start soon**.

Skills you will acquire

Working on the project, you will learn

- **analytical skills:** accurate analytical treatment of extended Higgs sectors, their symmetries and physical consequences — **you will learn that from me;**
- **critical thinking:** separating essential from redundant, telling physically relevant results from mathematical tricks — **we will develop that together;**
- **computer packages in HEP and astrophysics:** get to know LanHEP/CalcHEP, micrOMEGAs, HiggsBounds/HiggsSignals, etc. — **you will learn it from the authors/experts of these packages** (collaborators);
- **presenting your work:** writing short summaries, giving seminars (**opportunities to travel!**), writing papers and, eventually, your thesis — **you will learn it by yourself.**

All of these skills will be valuable for your future scientific projects.

The team

- **Igor Ivanov (CFTP)**: multi-Higgs sectors, symmetries/consequences, analytic methods;
- **Rui Santos (FCTC-UL, Lisboa)**: multi-Higgs sectors, computer packages, numerical analysis;
- **Maria Krawczyk, Dorota Sokolowska (Warsaw Univ., Poland)**: experience with model-building, DM computer packages;
- **Alexander Belyaev (Southampton Univ., UK)**: author fo CalcHEP, expert on HEP/DM packages, experience with bSM model building;
- **Maxim Laletin (Liege Univ., Belgium)**: PhD student ready to jump on the subject.

Join our team!