

## Job description:

### PhD position at Technical University of Munich to work for ALICE

#### Collaboration

Our Group at the Technische Universität München (TUM) (<https://www.denseandstrange.ph.tum.de/>) studies the properties of hadronic interactions and their implications for astro-particle physics by means of accelerator experiments.

One of the indirect ways to search for dark matter ( $\chi$ ) is to look for  $\chi\bar{\chi}$  annihilations resulting in final states such as  $p\bar{p}, e^+e^-, d\bar{d}$ ...with spectrometers placed on satellites or balloons. In particular, low energy  $\bar{d}$  seem to be optimal candidates for such searches, since cosmic ray-induced background does not contribute too much to this final state.

In order to estimate a reliable detection probability of dark matter-induced events such as  $\chi\bar{\chi} \rightarrow d\bar{d} + \dots$ , the interaction probability of  $\bar{d}$  with normal nuclear matter must be measured. Indeed, the latter drives the detection probability of antiparticles in the spectrometers; however  $\bar{d} + A$  ( $A = C, Al, Si, \dots$ ) elastic and inelastic cross-sections for low energies are completely unknown.

The topic of the here advertised PhD deals with the measurement of these interactions using the ALICE detector at the LHC. This is possible by analyzing pp collisions at  $\sqrt{s} = 13 \text{ TeV}$  measured by ALICE, since in these collisions a large statistics of  $\bar{p}$  and  $\bar{d}$  is produced and their interaction with the detector material can be investigated.

The PhD work will be structured in the following way:

- Analysis of the inclusive momentum spectra for  $\bar{p}$  and  $\bar{d}$  in pp collisions at  $\sqrt{s} = 13 \text{ TeV}$
- Development of a tracking algorithm to tag annihilation events of  $\bar{p}$  and  $\bar{d}$  within the ALICE TPC detector
- Evaluation of the effective  $\bar{d} + A$  ( $A = C, O, \dots$ ) inelastic cross-sections
- Estimation of the  $\bar{d}$  rates expected for different dark matter models in current and future satellite experiments.

Candidates are expected to hold a master degree in particle or nuclear physics at the time of appointment. Programming experience in C++ is highly recommended and experience with data analysis in ALICE Collaboration is an advantage. Good communication skills (English) and readiness to travel to international conferences are mandatory. Several weeks of presence at CERN are planned for service tasks within ALICE Collaboration and for taking shifts in the ALICE control room during Run 3 data taking period.

Applications including a CV (containing a brief summary of previous research activities and a one-page letter of motivation), a copy of the master certificate, copies of the university scores, as well as two letters of recommendation should be sent to Prof. Dr. Laura Fabbietti ([laura.fabbietti@ph.tum.de](mailto:laura.fabbietti@ph.tum.de)).

The position will be located at Physics Department of Technical University of Munich. The expected duration of the PhD program is three years, starting in July or August 2019. The salary is according to the German public service pay agreement (TV-L E13 65%).

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The application deadline is the 15<sup>th</sup> of May 2019.