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## Brief research statement

*Throughout my career, I have been driven by finding out more about the constituents of matter as well as by the challenges related to the "big science" needed to study them (complex instruments, vast amounts of data, an international community working together). I chose to pursue my research at the Large Hadron Collider (LHC), the largest discovery machine ever built by humankind that could produce dark matter (DM) particles in controlled conditions, contributing to the solution of a mystery of our universe. The narrative in this CV outlines the path I took to establish myself as a leading actor for LHC DM searches, with an ambition to pursue these searches using novel data selection techniques essential for discoveries in data-rich research environments.*

## Education

**2003-2008:** Undergraduate studies: Universita' di Roma 'Sapienza', Italy.

- Master's Degree, final marks: 110/110 Cum Laude, GPA: 29.7/30.
- Bachelor's Degree, final marks: 110/110 Cum Laude, GPA: 29.2/30.

**2008-2011:** D. Phil. Degree (16/12/2011), University of Oxford, Merton College, UK.
*Thesis title:* Measurement of the inclusive jet cross section with the ATLAS detector at the LHC.
*Supervisor:* Prof. Amanda Cooper-Sarkar.
*During my PhD, fully funded by external grants from UK, Italy and Sweden (see this Guardian article), I have become an expert in the identification, reconstruction and performance of the most common physics signature produced at the LHC: jets of particles originating from the constituents of the collided protons. My PhD thesis provides the first-ever estimate of the uncertainty on jet energy measurements in ATLAS, nominated as an outstanding contribution by the University of Oxford, published in the* Springer Theses series *and described in one of the 20 most cited LHC papers.*

## Postdoctoral experience (Previous positions)

**2011-2015:** Senior research and teaching assistant (Maître-assistante), University of Geneva, CH
*At the start of my post-doc I used my PhD knowledge to perform the first search for new particles decaying into two jets with early 2012 LHC data, probing the highest possible energy scales. In 2012 I was appointed co-convener of the Jets and Dark Matter group (70 members) to the publication of papers on searches for new physics with jets. My own research focused on DM and highlighted an unexplored region out of the reach of traditional data taking techniques. In 2014, I was appointed by ATLAS and CMS management to co-lead the Dark Matter Forum and in 2015 the LHC Dark Matter Working Group (~300 members) to disseminate recommendations on the search targets and interpretation of LHC DM searches. These years leading international groups of physicists while working hands-on on cutting-edge physics analysis were instrumental for the DARKJETS ERC StG research program to begin the exploration of low-mass DM mediators that is significantly extended with the REALDARK CoG research program.*

## Current positions

**2019-present:** Senior University Lecturer (Lektor), Lund University. Reader (docent) since 30/08/2017.
**2015-2019:** Associate Senior University Lecturer (Biträdande lektor), Lund University.
*As an associate professor at Lund University, I work with a post-doctoral researcher and two PhD students supported by the DARKJETS ERC StG. We deployed a real-time analysis technique called "Trigger-Level Analysis" (TLA) for the first time in the ATLAS experiment and applied it to dark matter searches, leading to the strongest constraints to date on DM mediator models. We disseminated our results through peer-reviewed papers that I edited, contributions at international conferences, press releases[1] and outreach events. TLA has also been added to the current issue of The Swedish Guide for Big Science and I continue being involved in synergistic activities (see below) as real-time analysis goes beyond the ATLAS experiment. The ongoing success of my Starting Grant, and the strong constraints set on WIMPs, motivated me to apply for this Consolidator grant proposal for further breakthroughs in analysis techniques and DM searches.*

## Fellowships and awards

**2003-2008:** Full scholarship at the Collegio Universitario Lamaro Pozzani**,** funded by the IT National Federation of Holders of the Order of Merit for Labour, hosting < 15 selected Italian students/year. Winner of INFN scholarship for physics graduates in particle physics (ranked 1st in Italy).

## Supervision of postdoctoral fellows, graduate and undergraduate students

**Main supervisor** of: **two postdocs** (William Kalderon 2016-09/2019, currently postdoctoral fellow at Brookhaven National Lab, Jannik Geisen 09/2019-now), **2 PhDs** (Eric Corrigan 2016-now, Eva Hansen 2016-now), **a Licentiate, 7 Master's, 8 Bachelor's students** (Lund University, supervised theses can be found on my website) who are now mostly pursuing PhDs in experimental or theoretical physics, 13 CERN summer students (Lund/Geneva). **Co-supervisor of 5 PhD students** (Lund/Geneva).

[1]For a press release about DARKJETS and its team, see this link.. For an interview in Italian see this link.

### Teaching, mentoring, and course development activities

**2015-:** *Lund University*. Course responsible for Particle Physics, Cosmology and Accelerators, Bachelor's degree at the Natural Sciences faculty. Co-teacher of various courses, including graduate-level course on Jupyter notebooks and Master's level course using ATLAS Open Data (described in the Proceedings of LHCP2018)
**2019-:** Steering group member for the COMPUTE research school in the LU Science/Engineering/Medicine Faculties, responsible for alumni network.

### Organization of selected scientific meetings of relevance for this proposal

**2020**: Co-organizer of the particle/astroparticle sessions at the Nordic Physics Days in Uppsala.
**2020:** Main organizer of the HEP Software Foundation / WLCG workshop in Lund (expected 250 participants)
**2019:** Overall programme committee chair of 23rd international conference on Computing for High Energy Physics (CHEP), Australia (500 pp)
**2018**: Main organizer of the Swedish particle physics community conference (Partikeldagarna) in Lund (80 pp)
**2016**: Scientific organizer committee of the Dark Matter workshop during KAW foundation's 100th anniversary symposium "Big Questions in Astrophysics" (36 pp)
**2015, 2017:** Chair of the "Dark Matter" and "Higgs and Beyond the Standard Model physics" sessions at the European Physical Society Conferences, Austria and Italy
**2014-:** Member of the local organizing committee for the Large Hadron Collider Physics Conference in Lund (350 participants). Chair of the Beyond the Standard Model and QCD session at the 3rd, 4th and 6 th editions of the LHCP conference (US, Sweden, Italy).
**2014-**: Session chair and organizer of DM@LHC conferences in Netherlands, UK and Germany (100 pp)
**2014:** Local organizer and responsible for logistics (350 participants) of Future Circular Colliders Kick-off meeting, Switzerland.

### Membership of scientific societies

**2020-:** Chair of the Swedish Particle Physics and Astrophysics Board, Swedish Physical Society
**2017-:** Elected member of the Swedish Particle Physics and Astrophysics Board.

### Grant review assignments:

Remote expert reviewer for ERC Grants.
Panel member for the annual merit-review and comparative-based research program for the U.S. Department of Energy, Washington, D.C. (USA).
Evaluator for the Merit Reviews of the Israel Science Foundation (ISF)

### Journal review assignments

Since 2016 Reviewer for the European Journal of High Energy Physics (JHEP)
Since 2018 Reviewer for the European Journal of Physics C (EPJC)

### Most recent synergistic and outreach activities:

2019: Organizing committee of 2-week Institute Pascal workshop on Real-time analysis, in Paris
2018-: Invited with other 15 Lund junior faculty to the LMK Foundation Idea Forum. Led to the funding of the interdisciplinary Pufendorf Institute Advanced Study Group on Real-time analysis with the faculties of Physics, Social Sciences, Law, Engineering, whose activities can be found here.
2018-: Convenor of HEP Software Foundation (HSF) Trigger and Reconstruction working group.
2020-: Overall co-coordinator of the HSF, with the aim of increasing cross-talk with astroparticle experiments.
2019-: Co-spokesperson and co-coordinator of the Lund-Hamburg Helmholtz International Research Graduate school HELIOS, on intelligent instrumentation for present and future physics facilities (see Funding ID).
2016-: Lund University responsible for the IPPOG Masterclasses in Particle Physics. In 2018 I started hosting the Masterclasses for the UN International Day of Women and Girls in Science, (open to all genders). LU Press release.

### Major collaborations (current/planned):

Within the LHC research environment, I have many close links with my international. This list contains the most relevant current and planned collaborations on the topics of this research proposal. The experts external to ATLAS who have agreed to collaborate on these topics are underlined.
Tancredi Carli (CERN, Switzerland): jet performance and jet triggers.
Graeme Stewart (CERN, Switzerland): trigger and data analysis, head of the HEP Software Foundation.
Vladimir Gligorov (LPNHE and Univ. Sorbonne, France): interdisciplinary implications of real-time analysis
Antonio Boveia (Ohio State University, USA), David Strom (University of Oregon, USA), Monica Dunford (Heidelberg University, Germany): trigger and WIMP DM searches.
Deepak Kar (University of Wits, South Africa), Marie-Hélène Genest (LPSC Grenoble): dark sector searches
Stefan Prestel (Lund University, Sweden): interleaved QCD and dark photon showers (Pythia author)
Felix Kahlhoefer. Michael Krämer (RTWH Aachen), Tilman Plehn (Heidelberg U.): dark sector searches
Torsten Akesson (Lund University, Sweden): non-WIMP DM searches, Lund University