Ongoing external funding

Project title	Funding source	Amounts Euro (SEK)	Period	Role of the PI	Relation to current proposal
Discovery strategies for DM and new phenomena in hadronic signatures with the ATLAS detector at the LHC	European Research Council	1270000	2016-2021	Sole PI	Proof-of-principle results for WP1-3, see below of this document for how this Consolidator Grant is a significant step beyond this Starting Grant.

This Consolidator grant is a **natural extension of the successful research program that was enabled by my Starting Grant, significantly expanded in ambition and experimental coverage**.

The research program in the Consolidator Grant is much more ambitious than the ERC program, extending the success of the TLA proof-of-principle technique that was novel for the ATLAS experiment to other fundamental particles and use cases. The data recorded with one of these extensions (TLA with photons) will be used in a search that I pioneered at the LHC, extending the world-best constraints to a discovery potential many orders of magnitude better. This research program and its work on data compression will also make TLA become a standard analysis technique that can be used by other members of the collaboration, allowing for more sensitive searches that are currently limited by trigger constraints and providing a solution to future challenges. Its use in combination with the Partial Event Building technique is completely new, and it will be used to search for a more complex search target with respect to the targets of my Starting Grant, moving from WIMP searches to well-motivated non-WIMP dark sector searches that have captured the interest of part of the theoretical community of DM experts.

The achievements of the Dark Matter Forum and Dark Matter Working Group in focusing the LHC DM community around a prioritized set of benchmark models and a way to present results in the context of direct and indirect searches for DM will be the stepping stone of a new initiative that includes the work already done and brings it into an even broader context that includes non-collider experiments, astrophysics, cosmology and multimessenger astronomy.

Such an ambitious research and dissemination program is only possible with the addition of four members to the Lund University team, namely two experienced postdoctoral researchers and two students that will be trained as part of this proposal, and with a profile for me as a PI that is mostly research-oriented (see justification for VR grant below).

This Consolidator grant extends real-time analysis as the stepping stone to new, more sensitive DM searches with broad theoretical motivations, and enables my research group and the ATLAS DM search community as a whole to make a major contribution to the global DM landscape. **This grant would establish me further as a leader in my field and responsible for a research program with physics and technical implications beyond high energy physics.**

Real-time Strategies and Precision Searches for Dark Sector Particles	VR (Swedish Research Council)	423020 (4400000)	2019-2024	Sole PI	Covering PI's salary and salary of PhD student. The PhD student will be spending 30% of their time on the development of machine learning algorithms for dark sector searches until mid-2022, but the models that they are targeting are different to those in this grant and the dataset will be collected using traditional data taking techniques. The majority of the work of the PhD student in 2021-2024 will be on the hardware for the ATLAS experiment upgrade and on the LDMX experiment, for work not directly related to this proposal.

It should be noted that the financing of the non-teaching employment of Swedish researchers and a large fraction of PhD student funding comes from national funding agencies rather than from the internal budget of the employing university. Researchers from EU countries who are dependent on a national funding agency should not be penalized with respect to others where the employment of the researcher is fully financed from the internal budget of the University.

It is only the combination of this current funding and the Consolidator Grant that will allow me to maintain a strong research-oriented profile and group that continues the very successful research line on dark matter enabled by novel data analysis techniques in ATLAS (recognized with a number of high-profile responsibilities in both computing/data analysis and dark matter communities). This combination also enables me to participate to a time-limited but still significant extent

to ATLAS upgrades and to a new promising experiment, the LDMX experiment, given the synergies with this proposal in terms of dark matter searches for models with new particles coupling to photons and electrons. While the searches in this proposal search for light dark matter mediators decaying to electrons within hadronic jets, the LDMX experiment searches for the invisible decays of these mediators. Participating in two complementary experiments offers the perfect scenario to verify discoveries and employ constraints to direct promising future search programs. Time sharing for me as a PI of both grants has been built in the time plan of this grant done with a professional Gantt chart software (OmniPlan), with an involvement in LDMX that grows to 20% in 2023 as foreseen in the VR project plan, still maintaining an average overall 70% involvement in the Consolidator grant throughout the grant period. Should I show the Gantt chart with my time involvement? In my StG one of the reviewers said my time planning was too detailed…					
INSIGHTS	MSCA	[amount]	2017-2021	Co-PI and co-supervisor of an Early Stage Researcher	None

On-going and submitted grant applications

Project title	**Funding source**	**Amounts Euro**	**Period**	**Role of the PI**	**Relation to current proposal**
Synergies between machine learning, real-time analysis and hybrid architectures for efficient event processing and decision making (SMARTHEP)	MSCA	Approx. 3M EUR (here: Lund student + coordinator funding or total funding?)	2016-2021	Coordinator	LHC-wide and industrial applications of real-time analysis techniques (not covered in this proposal)

Previous external funding

Project title	**Funding source**	**Amounts Euro (SEK)**	**Period**	**Role**	**Relation to current proposal**
Searches for DM and New Phenomena with the ATLAS detector at the Large Hadron Collider and beyond.	VR (Swedish Research Council)	230760 (2400000)	2015-2018	Sole PI	None