

Mads Toudal Frandsen  
Department of Physics, Chemistry and Pharmacy  
Physics  
**Email:** frandsen@cp3.sdu.dk  
**Phone:** +4565504521



## Research Interests

Particle physics phenomenology and astroparticle physics, data analysis and machine learning. I have co-developed novel models of dark matter and the Higgs based on composite dynamics. In parallel I have developed novel data analysis methods for dark matter particle experiments and astrophysical observations yielding new limits and insights on DM self couplings and couplings to ordinary matter. Recently I have co-proposed a cold atomic experiment in preparation to search for new light force carriers and have developed physics guided machine learning methods currently being applied to snapshot Hyperspectral Imaging.

## Employment

2020- Deputy Head of Dept. of Physics, Chemistry and Pharmacy  
2019-2020 Head of Section for Cosmology and Particle Physics  
2012- Associate Professor, CP<sup>3</sup>-Origins, SDU  
2009-2012 Postdoctoral Research Associate, Oxford University

## Education

2009 PhD in Physics, Niels Bohr Institute. Advisor Prof. F. Sannino. Thesis Minimal Walking Technicolor  
2006 Master in Physics, Niels Bohr Institute & UC Santa Barbara  
2004 Bachelor in Mathematics and Physics, Niels Bohr Institute

## Management, Boards and Memberships

2021- Co-initiated and co-lead SDU Galaxy network for space science and technology  
2021- Management member of Centre for Research in Science Education and Innovation (FNUG)  
2019- Member of the Danish Academy of Natural Sciences  
2019- Board member of Danish Student Cubesat programme  
2019- Member of the Ministry for higher education and science's space partnerships: Danmarks Partnerskab for Rum i Arktis, Partnerskabet for Rumrelaterede Uddannelser og Partnerskabet Science and Space Technology  
2018- Advisory Board member of Instrument center for Danish Astrophysics  
2015-2020 Member of The Young Academy (DUA) - Under the Royal Danish Academy of Sciences and Letters, 2015-2020  
2012-2014 ATLAS experiment (Diboson searches) at LHC associated theorist, CERN  
2012-2014 Long-term visitor, Theoretical Physics Oxford

## Parental Leave

Oct 3rd - Oct 17th and July 1st - August 31st 2013.  
Dec 6th - Dec 20th 2015 and Sept. 1st 2016 - Oct 31st 2016.  
Sept. 1st 2016 - Oct 31st 2016.

## Research Group

Assistant professor Wei-Chi Huang 2020-  
Post doc Wei-Chi Huang 2017-2020 (now Assistant Professor at CP3-Origins, SDU).  
Post doc Tommi Alanne, 2015-2017 (now Lecturer at The University of Liverpool)  
PhD's M. E. Thing 2022-  
Phd Sofie Martins (co-advisor) 2022-  
PhD M. R. Joergensen 2018-2021 (now Post Doc at Oxford University)  
PhD J. Petersen 2017-2021 (now Data Science Engineer at Velux)  
Scientific Assistants M. T. Kristensen 2022-, M.J. Ahlebaek 2022-, J. Gammeltoft 2022-, M.A.L. Kristensen 2019-2022  
10+ master students and 15+ bachelor students.

## Research grants

2022-2023	Food & Bio Cluster Denmark, Snapshot Hyperspectral Imaging for Food Science Across Multiple Scales, 0.3M DKK
2021-2022	CenSec, PGDA - Physics Guided Data Analysis, 0.415M DKK
2020-2024	Industriens Fond, Danish Student Cubesat programme, Co-I (PI C. Karoff), 4.3M DKK
2020-2023	Villum Foundation Experiment grant (with Co-I prof. S. Hoerberth, Bonn U.), Dark Matter Forces from Light-Matter interactions 2M DKK
2016-2021	DFF Sapere Aude starting grant, Origin of Mass and Particle Nature of Dark Matter, 6.8M DKK
2016	Carlsberg Foundation conference grant for DAVCo joint with C. Hagedorn, 50.000 DKK
2014-2016	Villum foundation Blok Stipendie (2 years of post doc salary for Tommi Alanne), ca. 1.5M DKK
2012	Independent Research Fund Denmark, Sapere Aude Research Fellowship (tillaegsbevilling), 750.000 DKK,
2012-2014	Independent Research Fund Denmark, Individual Post Doc Fellowship, Strong Origins - New strong interactions and the origin of mass and dark matter, ca. 1.8M DKK
2012	Rutherford 5-year fellowship with Oxford, from STFC, UK (declined for current position).
2011-2012	1 year Post Doctoral Research Associate Oxford (STFC).
2009-2011	Villum foundation 2-year Post Doc fellowship for Oxford University, 2009-2011.

## Industrial Grants

2022	Newtec Engineering A/S, computing time on dedicated Newtec GPU cluster, ca. 0.2M DKK
2021-2022	Newtec Engineering A/S, computing time on the SDU UCloud GPU cluster, ca. 20.000 DKK,

## Education, Recruitment and Outreach Grants

2022	Facebook, RadioSTAR, 150.000 DKK; Wieth-Knudsens Foundation (Co-I, with B. Dorch), 78.000 DKK,
2021	Teknologipagten, SDU Space Club, 224.000 DKK; Fabrikant Mads Clausen Fonden FysikLab 84.000 DKK
2020	HKH Kronprins Frederik og Kronprinsesse Marys Fond, SAMSTEM - fra klasserum til operationsrum, 200.000 DKK, Fonden for Entreprenskab, Inspire Educate Innovate Lab, 150.000 DKK,
2019	Villum Foundation and UngOdense Fra Atomer til Galakser, 590.000 DKK

## Awards

2018	University of Southern Denmark outreach and science communication prize
2018	Faculty of Natural Science outreach and science communication prize, SDU.
2010-2012	Elected Research Fellow, Manseld College, Oxford.
2020	Lundbeck Foundation Talent Prize, Copenhagen 2010.
2009	Anglo-Danish Society Award, Danish Embassy London, 2009.
2006	Loerup Honorary Graduate Award, Copenhagen, 2006
2005	Deans Honours, University of California, Santa Barbara

## Extended Research visits

2013	KITP Santa Barbara June-July (4 weeks)
2011	CERN July-August (6 weeks)
2007	CERN March-June (4 Months)
2012	Karin Dissauer (Joint with F. Sannino)

## Bachelor Students

2015	Martin Rosenlyst Joergensen (Dark Matter - Thermal Relics and LHC detection)
2015	Martin Berg Klenow (Higgs Physics - LHC detection)
2015	Henrik K. B. Siboni (Dark Matter - Direct Detection)
2015	Jonas Petersen (Dark Matter - Cluster Collisions)
2014	Nicky Klindt Vølund (Dark Matter- Cluster Collisions)
2014	Sofie Gregersen (Dark Matter- direct detection)
2014	Kevin Grønbech (Dark Matter- Cluster Collisions)
2013	Mette Lindharth Als Kristensen
2013	Rasmus Rexbye Hansen

## Teaching

2014	First year Classical Mechanics FF502 (~250 students)
2014	Second year Classical Mechanics FY504 (~30 students)
2013	Responsible for 3 day SRP workshop at CP <sup>3</sup> (8 high school students)
2013	First year Classical Mechanics FF502 (~250 students)
2013	Second year Classical Mechanics FY504 (~30 students)
2012	Second year Classical Mechanics FY504 (~30 students)
2012	first year lab exercises FY502 (~250 students)
2012	Nordita Master Class in Physics, Stockholm

## Honours and Awards

### Journals:

Referee for

JCAP (Journal of Cosmology and Astroparticle Physics)

PRD (Physical Review D)

CPC (Computer Physics Communications)

EPJ (European Physics Journal)

### Grants

Referee for FRIA 2013 call of the Fund for Scientific Research - FNRS, funding agency for scientific research in French-speaking Belgium

### Conferences:

Member of the Scientific Organizing Committee of Lattice Meets Experiment Workshop, Brookhaven 2013.

Organizer of Origin of Mass, SDU 2013

### Boards

Member of faggruppen for fysik under den bibliometriske forskningsindikator 2013-

Member of Instrumentcenter for dansk astrofysik (IDA) 2014 -

## In the media

### **Ufoer, konspirationer, dødsårsager og livsråd fra en kok**

Mads Toudal Frandsen

20/04/2022

1 Media contribution

### **Ufoer, konspirationer, dødsårsager og livsråd fra en kok**

Mads Toudal Frandsen

20/04/2022

1 Media contribution

### **Ufoer, konspirationer, dødsårsager og livsråd**

Mads Toudal Frandsen

20/04/2022

1 Media contribution

### **TV 2 Nyhederne 19.00**

Mads Toudal Frandsen

12/05/2022

1 Media contribution

### **Sun's dark matter trap**

Mads Toudal Frandsen

12/07/2010

1 Media contribution

### **SPØRG EKSPERTEN**

Mads Toudal Frandsen

20/05/2019  
1 Media contribution

**SOLEN I EN FLASKE**  
Mads Toudal Frandsen  
07/08/2021  
1 Media contribution

**Signaler fra rummet undrer**  
Mads Toudal Frandsen  
04/07/2020  
1 Media contribution

**Sex mellem menneske-arter og fundet af en berømt partikel: "10'erne var et stort årti for videnskaben"**  
Mads Toudal Frandsen  
22/12/2019  
1 Media contribution

**SDU-studerende skal sende satellitter over Arktis**  
Mads Toudal Frandsen  
21/11/2020  
1 Media contribution

**SDU øger sit fokus på rummet**  
Mads Toudal Frandsen  
27/05/2021  
1 Media contribution

**SDU intensiverer fokus på rummet i SDU Galaxy**  
Mads Toudal Frandsen  
08/03/2021  
1 Media contribution

**SDU intensiverer fokus på rummet i SDU Galaxy**  
Nicolai Iversen & Mads Toudal Frandsen  
08/03/2021  
1 Media contribution

**PRM / Varsling og invitation: Banebrydende forskningsresultater fra vores egen galakse offentliggøres 12. maj**  
Mads Toudal Frandsen  
29/04/2022  
1 Media contribution

**PRM / Nye, uforklarlige signaler fra rummet: Hvad foregår der?**  
Mads Toudal Frandsen  
03/07/2020  
1 Media contribution

**PRM / Nye, uforklarlige signaler fra rummet: Hvad foregår der?**  
Mads Toudal Frandsen  
03/07/2020  
1 Media contribution

**PRM / Makerspace, STEM-lab og sociale medier for svagtseende: Mød modtagerne af dette års Community Action Grants**  
Mads Toudal Frandsen  
04/05/2022

1 Media contribution

**PRM / Danske studerende bygger og styrer flere satellitter**

Mads Toudal Frandsen

13/03/2021

1 Media contribution

**PRM / Danske studerende bygger og styrer flere satellitter**

Mads Toudal Frandsen

13/03/2021

1 Media contribution

**Podcast: 85 procent af vores univers består af mørkt stof, som vi ikke aner, hvad er**

Mads Toudal Frandsen

22/08/2019

1 Media contribution

**Paradigmeskift: Sådan kan vi også lede efter mørkt stof**

Mads Toudal Frandsen

24/07/2015

1 item of Media coverage

**Opdagelsen af sorte huller, som ville kunne trække din krop til spaghetti, udløser en Nobelpris**

Mads Toudal Frandsen

06/10/2020

1 Media contribution

**Nyt millionprojekt: SDU-studerendes satellitter skal være gymnasieelevers øjne over Arktis**

Mads Toudal Frandsen

21/11/2020

1 Media contribution

**Nyt millionprojekt: SDU-studerendes satellitter skal være gymnasieelevers øjne over Arktis**

Mads Toudal Frandsen

21/11/2020

1 Media contribution

**Nye, uforklarlige signaler fra rummet: Hvad foregår der?**

Mads Toudal Frandsen

03/07/2020

1 Media contribution

**Nye, uforklarlige signaler fra rummet: Hvad foregår der?**

Mads Toudal Frandsen

03/07/2020

1 Media contribution

**Nye, uforklarlige signaler fra rummet: Hvad foregår der?**

Mads Toudal Frandsen

04/07/2020

1 Media contribution

**Nye, uforklarlige signaler fra rummet: Danske forskere undrer sig**

Mads Toudal Frandsen

05/07/2020

1 Media contribution

**Ny naturkraft?: Måling af elementarpartikel udfordrer standardmodellen**

Mads Toudal Frandsen

08/04/2022

1 Media contribution

**Ny naturkraft? Måling af elementarpartikel udfordrer standardmodellen**

Mads Toudal Frandsen

08/04/2022

1 Media contribution

**Ny naturkraft? Måling af elementarpartikel udfordrer det, vi troede**

Mads Toudal Frandsen

09/04/2022

1 Media contribution

**Ny naturkraft? Måling af elementarpartikel udfordrer det, vi troede**

Mads Toudal Frandsen

09/04/2022

1 Media contribution

**Ny naturkraft? Måling af elementarpartikel udfordrer det, vi troede**

Mads Toudal Frandsen

09/04/2022

1 Media contribution

**Ny naturkraft? Måling af elementarpartikel udfordrer det, vi troede**

Mads Toudal Frandsen

09/04/2022

1 Media contribution

**Ny naturkraft? Måling af elementarpartikel udfordrer det, vi troede**

Mads Toudal Frandsen

09/04/2022

1 Media contribution

**Ny naturkraft? Måling af elementarpartikel udfordrer det, vi troede**

Mads Toudal Frandsen

09/04/2022

1 Media contribution

**Ny naturkraft? Måling af elementarpartikel udfordrer det, vi troede**

Mads Toudal Frandsen

09/04/2022

1 Media contribution

**Nobelprisen gik til opdagelsen af de glubske sorte huller**

Mads Toudal Frandsen

07/10/2020

1 Media contribution

**New light cast on dark matter...: We may be a step closer to fathoming one of particle physics' deepest mysteries**

Mads Toudal Frandsen

26/05/2013

1 Media contribution

**New light cast on dark matter...**

Mads Toudal Frandsen

26/05/2013

1 item of Media coverage

**Navnligt -i dag med Phillip, der har brugt sin gen-forskning til at skrive en krimi**

Mads Toudal Frandsen

17/06/2016

1 item of Media coverage

**NATURVIDENSKAB VERDENSBILLEDER DEN STORE NEDTUR**

Mads Toudal Frandsen

30/01/2021

1 Media contribution

**Naturens superkræfter præsenteret én for én**

Mads Toudal Frandsen

13/02/2021

1 Media contribution

**Naturen kan ikke skrive et læserbrev**

Mads Toudal Frandsen

10/12/2021

1 Media contribution

**Når alt koges ned, findes der fire fundamentale naturkræfter. Fire!**

Mads Toudal Frandsen

12/02/2021

1 Media contribution

**Mystisk signal fra rummet**

Mads Toudal Frandsen

04/07/2020

1 Media contribution

**Mysteriet om mørkt stof og mørk energi, fortæller os, hvor lidt vi egentlig ved om universet**

Mads Toudal Frandsen

05/03/2021

1 Media contribution

**Mulig CERN-opdagelse kan føre til teori om alting**

Mads Toudal Frandsen

03/04/2016

1 item of Media coverage

**Mørkt stof og mørk energi fortæller os, hvor lidt vi fatter af alting**

Mads Toudal Frandsen

06/03/2021

1 Media contribution

**Makerspace, STEM-lab og sociale medier for svagtseende: Mød modtagerne af dette års Community Action Grants**

Mads Toudal Frandsen

04/05/2022

1 Media contribution

**KVANTE KARINA ER EN AF DE MANGE OPFINDELSER FRA CP -ORIGINS, DER SKAL VÆKKE DE HELT UNGES INTERESSE FOR NATURVIDENSKABEN 3**

Mads Toudal Frandsen  
30/07/2018  
1 Media contribution

**Historisk billede afsløret: Her er det sorte hul i midten af Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Her er den absurd korte historie om, hvordan vi opdagede, at mennesket ikke er verdens navle**

Mads Toudal Frandsen  
29/01/2021  
1 Media contribution

**Heart of darkness could explain sun mysteries**

Mads Toudal Frandsen  
04/07/2010  
1 item of Media coverage

**Heart of darkness could explain sun mysteries**

Mads Toudal Frandsen  
14/07/2010  
1 Media contribution

**Fra det største til det mindste**

Mads Toudal Frandsen  
30/07/2018  
1 Media contribution

**Fra det største til det mindste**

Mads Toudal Frandsen  
17/08/2018  
1 Media contribution

**Forskningens Døgn med bamsehospital og partikelkanon**

Mads Toudal Frandsen  
24/04/2019  
1 Media contribution

**Forskningens Døgn med bamsehospital og partikelkanon**

Mads Toudal Frandsen  
24/04/2019  
1 Media contribution

**Forskningens Døgn byder på bamsehospital, partikelkanon og Thomas Skov**

Mads Toudal Frandsen  
24/04/2019  
1 Media contribution

**Forskere undrer sig over signaler fra rummet: Hvad foregår der?**

Mads Toudal Frandsen  
03/07/2020  
1 Media contribution



**Forskere tager første foto af Mælkevejens sorte hul**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere har afsløret historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**  
Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**Forskere afslører historisk billede af sort hul i Mælkevejen**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**For lækker til (natur)love**

Mads Toudal Frandsen  
28/02/2014  
1 item of Media coverage

**For 100 år siden lærte vi at forstå Solen. Nu er vi ved at være klar med en kopi**

Mads Toudal Frandsen  
06/08/2021  
1 Media contribution

**Er universet mon asymmetrisk**

Mads Toudal Frandsen  
07/06/2011  
1 item of Media coverage

**Elektromagnetismen er stadig fyldt med mysterier 200 år efter Ørsteds store opdagelse**

Mads Toudal Frandsen  
18/12/2020  
1 Media contribution

**Efter Higgs: Jagten på ny fysik: Den berømte Higgs-partikel er fundet, men fysikerne holder ikke op med at lede. Higgs-partiklen opfører sig nemlig ganske som forudsagt – og det er netop problemet. Der mangler stadig noget.**

Mads Toudal Frandsen  
29/03/2013  
1 Media contribution

**Efter Higgs: Jagten på ny fysik**

Mads Toudal Frandsen  
29/03/2013  
1 item of Media coverage

**DR1 TV Avisen 21.30**

Mads Toudal Frandsen  
03/05/2018  
1 Media contribution

**DR1 TV Avisen 18.30**

Mads Toudal Frandsen  
03/05/2018  
1 Media contribution

**DR1 TV Avisen 18.30**

Mads Toudal Frandsen  
12/05/2022  
1 Media contribution

**dk4 fortæller om fadervor gennem 11 programmer**

Mads Toudal Frandsen  
30/01/2020  
1 Media contribution

**Det Globale Eventyr: Allerede på vej ud i verden som ph.d.**

Mads Toudal Frandsen  
01/01/2009  
1 Media contribution

**Det er lettere at få job, hvis man har en uddannelse indenfor de naturfaglige fag**

Mads Toudal Frandsen  
03/05/2018  
1 Media contribution

**Det er blevet mere populært at læse naturvidenskabelige fag**

Mads Toudal Frandsen  
04/05/2018  
1 Media contribution

**Den sande historie om en falsk planet**

Mads Toudal Frandsen  
06/02/2021  
1 Media contribution

**Dark Matter May Be Building Up Inside the Sun**

Mads Toudal Frandsen  
07/09/2010  
1 Media contribution

**Dark matter may be building up inside our own sun**

Mads Toudal Frandsen  
12/07/2010  
1 item of Media coverage

**Danske studerende skal sende deres egen satellit op næste sommer**

Mads Toudal Frandsen  
25/03/2021  
1 Media contribution

**Danske studerende bygger og styrer flere satellitter**

Mads Toudal Frandsen  
13/03/2021  
1 Media contribution

**Danmarks første astronaut i rummet: Andreas Mogensen skal sparke døren ind til naturvidenskaben for fynske unge**

Mads Toudal Frandsen  
01/12/2019  
1 Media contribution

**CERN's Higgs Discovery As Portal To New 'Technicolor' Physics**

Mads Toudal Frandsen  
19/11/2014  
1 item of Media coverage

**Big Bang: Nyt studie giver hidtil bedste forståelse af det første stof, der nogensinde har eksisteret**

Mads Toudal Frandsen  
21/05/2021  
1 Media contribution

**Astronomer opdager mystisk signal fra fjerne galakser**

Mads Toudal Frandsen

02/07/2014

1 item of Media coverage

**Astronomer opdager et mystisk signal fra fjerne galakser**

Mads Toudal Frandsen

02/07/2014

1 item of Media coverage

**Are CDMS and XENON both right about dark matter?**

Mads Toudal Frandsen

25/04/2013

1 item of Media coverage

**Are CDMS and XENON both right about dark matter?**

Mads Toudal Frandsen

25/04/2013

1 Media contribution

**Andreas Mogensen skal lokke fynske unge ind i nyt fritidstilbud**

Mads Toudal Frandsen

01/12/2019

1 Media contribution

**Andreas Mogensen skal lokke fynske unge ind i nyt fritidstilbud**

Mads Toudal Frandsen

17/12/2019

1 Media contribution

**13-årige Malak drømmer selv om at blive det – nu har hun mødt Danmarks første astronaut**

Mads Toudal Frandsen

17/12/2019

1 Media contribution

**13-årige Malak drømmer selv om at blive det - nu har hun mødt Danmarks første astronaut**

Mads Toudal Frandsen

17/12/2019

1 Media contribution

**13-årige Malak drømmer selv om at blive det - nu har hun mødt Danmarks første astronaut**

Mads Toudal Frandsen

17/12/2019

1 Media contribution

**12. maj 2022 kl. 20:00**

Mads Toudal Frandsen

12/05/2022

1 Media contribution

**»Kan være hint om ny naturkraft«: Måling af elementarpartikel udfordrer standardmodellen**

Mads Toudal Frandsen

07/04/2022

1 Media contribution

## Publications

### **Techni-composite Higgs models with symmetric and asymmetric dark matter candidates**

Cacciapaglia, G., Frandsen, M. T., Huang, W. C., Rosenlyst, M. & Sørensen, P., 1. Oct 2022, In: Physical Review D. 106, 7, 075022.

### **The application of convolutional neural networks for tomographic reconstruction of hyperspectral images**

Huang, W. C., Peters, M. S., Ahlebaek, M. J., Frandsen, M. T., Eriksen, R. L. & Jørgensen, B., Sep 2022, In: Displays. 74, 102218.

### **Electroweak precision tests of composite Higgs models**

Frandsen, M. T. & Rosenlyst, M., 4. Jul 2022, (Submitted) In: Journal of High Energy Physics.

### **The hybrid approach – Convolutional Neural Networks and Expectation Maximization Algorithm – for Tomographic Reconstruction of Hyperspectral Images**

Frandsen, M. T., Huang, W-C., Peters, M. S., Eriksen, R. L., Jørgensen, B. & Ahlebaek, M. J., 2022, (In preparation) In: arxiv.org.

### **A cusp-core-like challenge for modified Newtonian dynamics**

Eriksen, M. H., Frandsen, M. T. & From, M. H., Dec 2021, In: Astronomy and Astrophysics. 656, 13 p., A123.

### **Techni-Composite Higgs models with (a)symmetric dark matter candidates**

Cacciapaglia, G., Frandsen, M. T., Huang, W-C., Rosenlyst, M. & Sørensen, P., 17. Nov 2021, arXiv.org, 13 p.

### **Large Higgs quartic coupling and (A)DM from extended Bosonic Technicolor**

Frandsen, M. T. & Huang, W-C., 10. Jan 2021, In: Physics Letters B: Particle Physics, Nuclear Physics and Cosmology. 812, 7 p., 136004.

### **XENON1T solar axion and the Higgs boson emerging from the dark**

Cacciapaglia, G., Cai, C., Frandsen, M. T., Rosenlyst, M. & Zhang, H. H., 1. Oct 2020, In: Physical Review D. 102, 7, 9 p., 075018.

### **A Method for Discriminating Between Dark Matter Models and MOND Modified Inertia via Galactic Rotation Curves**

Petersen, J. & Frandsen, M. T., Aug 2020, In: Monthly Notices of the Royal Astronomical Society. 496, 2, p. 1077–1091

### **Higgs Boson Emerging from the Dark**

Cai, C., Zhang, H. H., Cacciapaglia, G., Rosenlyst, M. & Frandsen, M. T., 10. Jul 2020, In: Physical Review Letters. 125, 2, 6 p., 021801.

### **Walking technicolor in light of Z' searches at the LHC**

Belyaev, A., Coupe, A., Frandsen, M., Olaiya, E. & Shepherd-Themistocleous, C., 1. Mar 2019, In: Physical Review D. 99, 5, 39 p., 055004.

### **Baggrundsstøj**

Frandsen, M. T., 2019, In: Dansk Kirketidende. 2

### **PISA-undersøgelser 1589-2018**

Frandsen, M. T., 2019, In: Dansk Kirketidende. 11

### **Tal og tale**

Frandsen, M. T., 2019, In: Dansk Kirketidende. 8

## **Usynlige**

Frandsen, M. T., 2019, In: Dansk Kirketidende. 5

## **Dark matter in (partially) composite Higgs models**

Alanne, T., Franzosi, D. B., Frandsen, M. T. & Rosenlyst, M., Dec 2018, In: Journal of High Energy Physics. 2018, 12, 88.

## **Investigating Dark Matter and MOND Models with Galactic Rotation Curve Data**

Frandsen, M. T. & Petersen, J., 27. May 2018, In: arxiv.org.

## **Asymmetric dark matter, baryon asymmetry and lepton number violation**

Frandsen, M. T., Hagedorn, C., Huang, W. C., Molinaro, E. & Päs, H., 2018, In: Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics. 782, p. 387-394

## **Partially composite Higgs models: phenomenology and RG analysis**

Alanne, T., Buarque Franzosi, D., Frandsen, M. T., Kristensen, M. L. A., Meroni, A. & Rosenlyst, M., 2018, In: Journal of High Energy Physics. 2018, 1, 26 p., 51.

## **Partially composite Goldstone Higgs boson**

Alanne, T., Franzosi, D. B. & Frandsen, M. T., 2017, In: Physical Review D. 96, 9, 7 p., 095012.

## **Symmetries and composite dynamics for the 750 GeV diphoton excess**

Franzosi, D. B. & Frandsen, M. T., 18. Mar 2016, In: arxiv.org. 11 p.

## **Asymmetric Dark Matter Models and the LHC Diphoton Excess**

Frandsen, M. T. & Shoemaker, I. M., 2016, In: Journal of Cosmology and Astroparticle Physics. 2016, May, 27 p., 064.

## **New or $\nu$ missing energy: Discriminating Dark Matter from Neutrino Interactions at the LHC**

Franzosi, D. B., Frandsen, M. T. & Shoemaker, I. M., 2016, In: Physical Review D. 93, 9, p. 095001-1-095001-10 095001.

## **Testing a dynamical origin of standard model fermion masses**

Alanne, T., Frandsen, M. T. & Franzosi, D. B., 2016, In: Physical Review D. 94, 7, p. 071703-1-071703-6 071703(R).

## **Vector and Axial-vector resonances in composite models of the Higgs boson**

Franzosi, D. B., Cacciapaglia, G., Cai, H., Deandrea, A. & Frandsen, M., 2016, In: Journal of High Energy Physics. 2016, 76, 42 p.

## **Diboson Signals via Fermi Scale Spin-One States**

Franzosi, D. B., Frandsen, M. T. & Sannino, F., 8. Dec 2015, In: Physical Review D. 92, 115005.

## **Unitarity implications of diboson resonance in the TeV region for Higgs physics**

Cacciapaglia, G. & Frandsen, M. T., 29. Sep 2015, In: Physical Review D.

## **Custodial vector model**

Becciolini, D., Franzosi, D. B., Foadi, R., Frandsen, M. T., Hapola, T. & Sannino, F., 2015, In: Physical Review D. 92, 22 p., 015013.

## **Direct Detection Phenomenology in Models Where the Products of Dark Matter Annihilation Interact with Nuclei**

Cherry, J. F., Frandsen, M. T. & Shoemaker, I. M., 2015, In: Physical Review Letters. 114, 23, 6 p., 231303.

## **X-ray lines from dark matter: the good, the bad, and the unlikely**

Frandsen, M., Sannino, F., M. Shoemaker, I. & Svendsen, O., 23. May 2014, In: JCAP. 5, 5, 033.

**LUX constraints on magnetic dark matter in a perturbative extension of the standard model with(out) naturality**

T. Frandsen, M., Sannino, F., M. Shoemaker, I. & Svendsen, O., 6. Mar 2014, In: Physical Review D. 89, 5, 055004.

**Colliding clusters and dark matter self-interactions**

Kahlhoefer, F., Schmidt-Hoberg, K., Frandsen, M. T. & Sarkar, S., 2014, In: Royal Astronomical Society. Monthly Notices. 437, 3, p. 2865-2881

**Halo-independent direct detection of momentum-dependent dark matter**

Cherry, J. F., Frandsen, M. T. & Shoemaker, I. M., 2014, In: Journal of Cosmology and Astroparticle Physics. 10, 19 p., 022.

**Technicolor Higgs boson in the light of LHC data**

Belyaev, A., S. Brown, M., Foadi, R. & Frandsen, M. T., 2014, In: Physical Review D. 90, 3, 035012.

**Up-shot of inelastic down-scattering at CDMS-Si**

Frandsen, M. T. & M. Shoemaker, I., 2014, In: Physical Review D. 89, 5, 5 p., 051701.

**Perturbative extension of the standard model with a 125 GeV Higgs boson and magnetic dark matter**

Dissauer, K., Frandsen, M. T., Hapola, T. & Sannino, F., 4. Feb 2013, In: Physical Review D - Particles, Fields, Gravitation and Cosmology. 87, 3, 035005.

**125 GeV Higgs boson from a not so light technicolor scalar**

Foadi, R., Frandsen, M. T. & Sannino, F., 2013, In: Physical Review D. 87, 9, 7 p., 095001.

**The unbearable lightness of being: CDMS versus XENON**

Frandsen, M. T., Kahlhoefer, F., McCabe, C., Sarkar, S. & Schmidt-Hoberg, K., 2013, In: Journal of Cosmology and Astroparticle Physics. 2013, 023.

**Perturbative extension of the standard model with a 125 GeV Higgs and Magnetic Dark Matter**

Dissauer, K., Frandsen, M. T., Hapola, T. & Sannino, F., 21. Nov 2012, In: Physical Review D.

**Discovering a Light Scalar or Pseudoscalar at The Large Hadron Collider**

Frandsen, M. T. & Sannino, F., 18. Mar 2012, In: Physical Review D.

**LHC and Tevatron bounds on the dark matter direct detection cross-section for vector mediators**

Frandsen, M. T., Kahlhoefer, F., Preston, A., Sarkar, S. & Schmidt-Hoberg, K., 2012, In: Journal of High Energy Physics. 2012, p. 123 25 p.

**Light Higgs from Scalar See-Saw in Technicolor**

Foadi, R. & Frandsen, M. T., 2012, In: Journal of High Energy Physics.

**Loop-induced dark matter direct detection signals from gamma-ray lines**

Frandsen, M. T., Haisch, U., Kahlhoefer, F., Mertsch, P. & Schmidt-Hoberg, K., 2012, In: Journal of Cosmology and Astroparticle Physics. 10, p. 033

**Resolving astrophysical uncertainties in dark matter direct detection**

Frandsen, M. T., Kahlhoefer, F., McCabe, C., Sarkar, S. & Schmidt-Hoberg, K., 2012, In: Journal of Cosmology and Astroparticle Physics. January 2012, 024.

**Boosted objects: a probe of beyond the standard model physics**

Abdesselam, A., Belyaev, A., Kuutmann, E. B., Bitenc, U., Brooijmans, G., Butterworth, J., de Renstrom, P. B., Franzosi, D. B., Buckingham, R., Chapleau, B., Dasgupta, M., Davison, A., Dolen, J., Ellis, S., Fassi, F., Ferrando, J., Frandsen, M. T., Frost, J., Gadfort, T., Glover, N., & 44 others Haas, A., Halkiadakis, E., Hamilton, K., Hays, C., Hill, C., Jackson, J.,



Issever, C., Karagoz, M., Katz, A., Kreczko, L., Krohn, D., Lewis, A., Livermore, S., Loch, P., Maksimovic, P., March-Russell, J., Martin, A., McCubbin, N., Newbold, D., Ott, J., Perez, G., Policchio, A., Rappoccio, S., Raklev, A. R., Richardson, P., Salam, G. P., Sannino, F., Santiago, J., Schwartzman, A., Shepherd-Themistocleous, C., Sinervo, P., Sjoelin, J., Son, M., Spannowsky, M., Strauss, E., Takeuchi, M., Tseng, J., Tweedie, B., Vermilion, C., Voigt, J., Vos, M., Wacker, J., Wagner-Kuhr, J. & Wilson, M. G., 2011, In: The European Physical Journal C: Particles and Fields. 71, 6, p. 1661

#### **Cosmic Sum Rules**

T. Frandsen, M., Masina, I. & Sannino, F., 2011, In: Physical Review D. 83, 12, p. 127301 4 p.

#### **Cosmic-ray sum rules**

Masina, I., Sannino, F. & Frandsen, M. T., 2011, In: Physical Review D. 83, 12, p. 127301 4 p.

#### **Delineating the conformal window**

Frandsen, M. T., Pickup, T. & Teper, M., 2011, In: Physics Letters B: Particle Physics, Nuclear Physics and Cosmology. 695, 1-4, p. 231-237

#### **Direct detection of dark matter in models with a light Z'**

Frandsen, M. T., Kahlhoefer, F., Sarkar, S. & Schmidt-Hoberg, K., 2011, In: Journal of High Energy Physics. September 2011, 128.

#### **Light asymmetric dark matter from new strong dynamics**

Frandsen, M. T., Sarkar, S. & Schmidt-Hoberg, K., 2011, In: Physical Review D. 84, 051703(R).

#### **Mixed dark matter from technicolor**

Belyaev, A., T. Frandsen, M., Sannino, F. & Sarkar, S., 2011, In: Physical Review D. 83, 1, p. 015007 9 p.

#### **On the DAMA and CoGeNT Modulations**

Frandsen, M. T., Kahlhoefer, F., March-Russell, J., McCabe, C., McCullough, M. & Schmidt-Hoberg, K., 2011, In: Physical Review D. 84, 4, 5 p., 041301.

#### **Vanilla Technicolor at Linear Colliders**

T. Frandsen, M., Jarvinen, M. & Sannino, F., 2011, In: Physical Review D. D84, 3, p. 035025 13 p.

#### **iTIMP: isotriplet Technicolor Interacting Massive Particle as Dark Matter**

T. Frandsen, M. & Sannino, F., 27. May 2010, In: Physical Review D. 81, 9, p. 097704 4 p.

#### **Asymmetric dark matter and the Sun**

Frandsen, M. T. & Sarkar, S., 2010, In: Physical Review Letters. 105, 1, 4 p., 011301.

#### **Fourth Lepton Family is Natural in Technicolor**

T. Frandsen, M., Masina, I. & Sannino, F., 2010, In: Physical Review D. 81, 3, p. 035010 18 p.

#### **From the LHC to Future Colliders**

De Roeck, A., Ellis, J., Grojean, C., Heinemeyer, S., Jakobs, K., Weiglein, G., Wells, J., Azuelos, G., Dawson, S., Gripaios, B., Han, T., Hewett, J., Lancaster, M., Mariotti, C., Moortgat, F., Moortgat-Pick, G., Polesello, G., Riemann, S., Schumacher, M., Assamagan, K., & 44 others Bechtle, P., Carena, M., Chachamis, G., F. Chen, K., De Curtis, S., Desch, K., Dittmar, M., Dreiner, H., Dührssen, M., Foster, B., T. Frandsen, M., Giammanco, A., Godbole, R., Govoni, P., Gunion, J., Hollik, W., S. Hou, W., Isidori, G., Juste, A., Kalinowski, J., Korytov, A., Kou, E., Kraml, S., Krawczyk, M., Martin, A., Milstead, D., Morton-Thurtle, V., Moenig, K., Mele, B., Ozcan, E., Pieri, M., Plehn, T., Reina, L., Richter-Was, E., Rizzo, T., Rolbiecki, K., Sannino, F., Schram, M., Smillie, J., Sultansoy, S., Tattersall, J., Uwer, P., Webber, B. & Wienemann, P., 2010, In: The European Physical Journal C: Particles and Fields. 66, 3-4, p. 525-583

#### **Technicolor Dark Matter**

Foadi, R., Frandsen, M. T. & Sannino, F., 1. Jan 2009, In: Physical Review D. D80, 3, p. 037702 4 p.

### **Technicolor Walks at the LHC**

Sannino, F., Foadi, R., Frandsen, M. T., Järvinen, M., Belyaev, A. & Pukhov, A., 2009, In: Physical Review D. D79, 3, p. 035006 32 p.

### **Higher representations on the lattice: perturbative studies**

Sannino, F., Del Debbio, L., Panagopoulos, H. & Frandsen, M. T., 3. Jun 2008, In: Journal of High Energy Physics. 22 p.

### **Constraining walking and custodial technicolor**

Sannino, F., Foadi, R. & Frandsen, M. T., 2008, In: Physical Review D. 77 D, 9, p. 097702 4 p.

### **Minimal Walking Technicolor**

Frandsen, M. T., 23. Oct 2007, In: SUSY 2007 proceedings, 15th International Conference on Supersymmetry and Unification of Fundamental Interactions, July 26 - August 1, 2007, Karlsruhe, Germany.

### **Minimal Walking Technicolor: Set Up for Collider Physics**

Foadi, R., Frandsen, M. T., Rytov, T. & Sannino, F., 12. Jun 2007, In: Physical Review D. 76, 5, 17 p., 055005.

### **Corrigan-Ramond Extension of QCD at Nonzero Baryon Density**

T. Frandsen, M., Kouvaris, C. & Sannino, F., 2006, In: Physical Review D. 74, p. 117503

## **Activities**

### **24th Nordic Particle Physics Meeting, Spaatind**

Mads Toudal Frandsen (Keynote speaker)

2016 → ...

### **5th Odense Winter School on Theoretical Physics**

Mads Toudal Frandsen (Organizer)

8. Oct 2012 → 12. Oct 2012

### **Akademiet for talentfulde unge besøger CP3**

Mads Toudal Frandsen (Lecturer)

12. Mar 2013

### **ARK MATTER: ASTROPHYSICAL PROBES, LABORATORY TESTS, AND THEORY ASPECTS**

Mads Toudal Frandsen (Participant)

2015 → ...

### **AT-dage**

Mads Toudal Frandsen (Lecturer)

14. Feb 2014 → 19. Feb 2014

### **Bestyrelsen for The Danish Student Cubesat prOgramme (DISCO) (External organisation)**

Mads Toudal Frandsen (Member)

2020 → ...

### **Beyond the LHC**

Mads Toudal Frandsen (Speaker)

22. Jul 2013 → 29. Jul 2013

### **Big Bang og mørkt stof**

Mads Toudal Frandsen (Lecturer)

8. May 2014

**Bright Ideas on Dark Matters**

Mads Toudal Frandsen (Organizer)  
31. Mar 2014 → 11. Apr 2014

**Brobygger foredrag for 25 Gymnasie-elever**

Mads Toudal Frandsen (Lecturer)  
25. Oct 2012

**CERN (External organisation)**

Mads Toudal Frandsen (Member)  
2012 → ...

**Composite Dynamics for EWSB and Dark Matter**

Mads Toudal Frandsen (Participant)  
2015

**Composite Dynamics: from Lattice to the LHC Run II**

Mads Toudal Frandsen (Keynote speaker)  
4. Apr 2016 → 9. Apr 2016

**CP3-Seminar**

Mads Toudal Frandsen (Speaker)  
2016

**Den bibliometriske forskningsindikator (External organisation)**

Mads Toudal Frandsen (Member)  
22. Jan 2014

**Det Unge Akademi (External organisation)**

Mads Toudal Frandsen (Member)  
2015 → 2020

**Foredrag om detektorer og acceleratorer**

Mads Toudal Frandsen (Lecturer)  
11. Sep 2013

**Future of Fundamental Interactions Interactions**

Mads Toudal Frandsen (Speaker)  
2015

**Giersing Realskole besøger CP3**

Mads Toudal Frandsen (Lecturer)  
27. Sep 2012

**Higgs Symposium**

Mads Toudal Frandsen (Participant)  
9. Jan 2013 → 11. Jan 2013

**Instrumentcenter for dansk astrofysik (External organisation)**

Mads Toudal Frandsen (Member)  
2014

**IPPP**

Mads Toudal Frandsen (Speaker)  
28. Feb 2013

**Mørkt stof**

Mads Toudal Frandsen (Lecturer)  
11. Apr 2013

**Mørkt stof i Universet**

Mads Toudal Frandsen (Lecturer)  
10. Apr 2012

**ngly interacting dynamics beyond the Standard Model and the Higgs boson**

Mads Toudal Frandsen (Speaker)  
24. Apr 2013 → 26. Apr 2013

**Nordita Master Class in Physics 2012**

Mads Toudal Frandsen (Speaker)  
28. Jul 2012 → 2. Aug 2012

**Nordita Winter School**

Mads Toudal Frandsen (Lecturer)  
Jan 2015

**Origin of Mass 2013**

Mads Toudal Frandsen (Organizer)  
5. Aug 2013 → 23. Aug 2013

**Oxford Journal Club**

Mads Toudal Frandsen (Speaker)  
7. Feb 2013

**Particle physics for high school teachers**

Mads Toudal Frandsen (Lecturer)  
17. Jan 2013

**Partnerskab for Rumrelaterede uddannelser - uddannelses og forskningsministeriet (External organisation)**

Mads Toudal Frandsen (Member)  
2020 → ...

**Rudolf Peierls Center for Theoretical Physics (External organisation)**

Mads Toudal Frandsen (Member)  
2012 → ...

**Scientific Organizing Committee "Lattice Meets Experiment 2013: Beyond the Standard Model" (External organisation)**

Mads Toudal Frandsen (Member)  
5. Dec 2013 → 6. Dec 2013

**Searches for Compositeness**

Mads Toudal Frandsen (Lecturer)  
2015

**Standardmodellen, CERN og Higgs partiklen.**

Mads Toudal Frandsen (Lecturer)

4. Feb 2014

**Strategy Workshop on Astroparticle Physics in Switzerland**

Mads Toudal Frandsen (Lecturer)

11. Jun 2014

**Students from Slagelse Gymnasium visit CP<sup>3</sup>-Origins**

Mads Toudal Frandsen (Lecturer)

20. Mar 2013

**Tiden efter opdagelsen af Higgs-partiklen**

Mads Toudal Frandsen (Lecturer)

1. Nov 2012

**Universets gåder - Big Bang, mørkt stof og Higgs partiklen**

Mads Toudal Frandsen (Lecturer)

17. Feb 2014

**University of Southern Denmark**

Mads Toudal Frandsen (Visiting lecturer)

10. Jun 2013 → 30. Jun 2013

**WIN2015**

Mads Toudal Frandsen (Speaker)

2015 → ...