Astroparticle Physics in Austria

University of Innsbruck - University of Graz
TU Wien - *Austrian Academy of Sciences*

signatory (signed by Jochen Schieck, director of HEPHY)

Josef Pradler, Institute of High Energy Physics (HEPHY), Austrian Academy of Sciences

Institutions with related physics faculties

Funding landscape

Der Wissenschaftsfonds.

Austrian Science Fund FWF primary funding agency, diverse portfolio of programs from stand-alone grants (~400 kEUR) to special research branches (SFB's ~ few Mio EUR) to Excellence Clusters (new, ~ 20 Mio)

FFG

Austrian Research Promotion Agency (FFG) is the national funding agency for industrial research and development in Austria

erc

Current Grants in Astroparticle Physics:
StG: Oliver Hahn "COSMO-SIMS" (University of Vienna)
CoG: Glenn van de Ven "ArcheoDyn" (University of Vienna)
CoG: Josef Pradler "NLO-DM" (HEPHY)

Federal Ministry
Republic of Austria
Education, Science
and Research

Enables participation in major research infrastructures (CTA, CERN,…)
(~40 Mio EUR p.a. total)

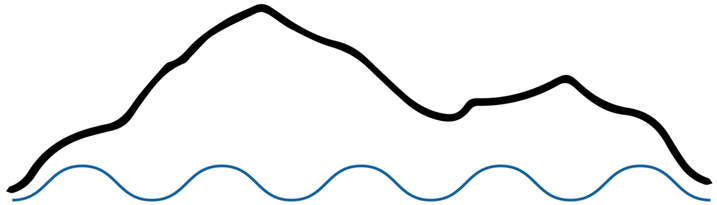
Dark Matter (and neutrino) groups

TU Wien & HEPHY Austrian Academy of Sciences

Jochen Schieck, Florian Reindl, Josef Pradler,
Suchita Kulkarni, Glenn van den Ven et al.

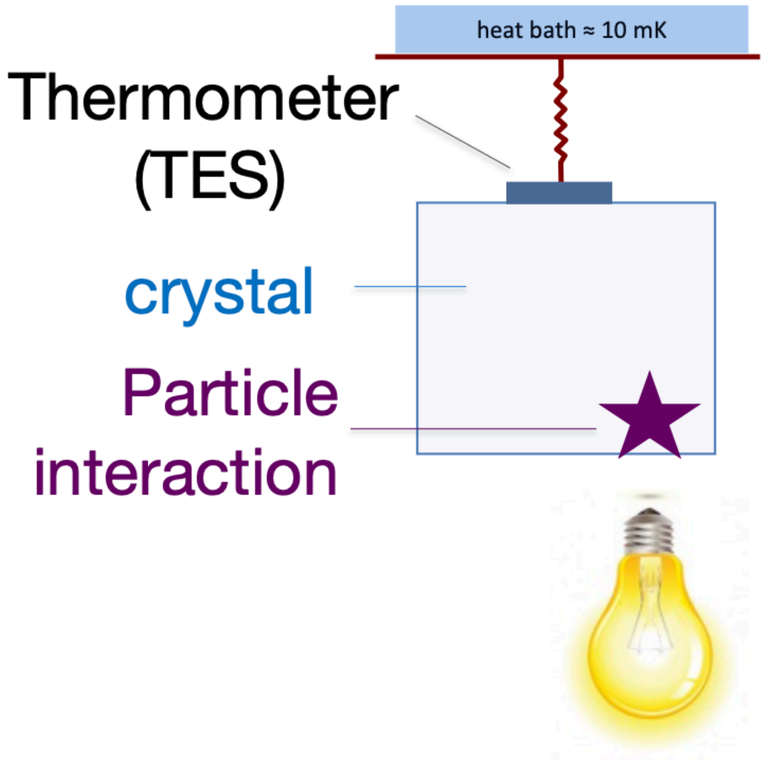
- CRESST @ LNGS
- COSINUS @ LNGS
- NUCLEUS @ CHOOZ
- Theory groups at HEPHY & University of Graz
- Observation & Simulation group at University of Vienna

CRESST
Cryogenic **Rare Event Search**
with Superconducting Thermometers



CRESST & COSINUS

SCINTILLATING CALORIMETER



Phonon signal (~90 %)

(Almost) independent of particle type

Precise measurement of the deposited energy

Scintillation light (few %)

Particle-type dependent
→ LIGHT QUENCHING

CRESST

Cryogenic **Rare Event Search**
with Superconducting Thermometers

COMENIUS UNIVERSITY BRATISLAVA

EBERHARD KARLS UNIVERSITÄT TÜBINGEN

TECHNISCHE UNIVERSITÄT MÜNCHEN

HEPHY INSTITUT FÜR HOCHENERGIEPHYSIK

TU WIEN

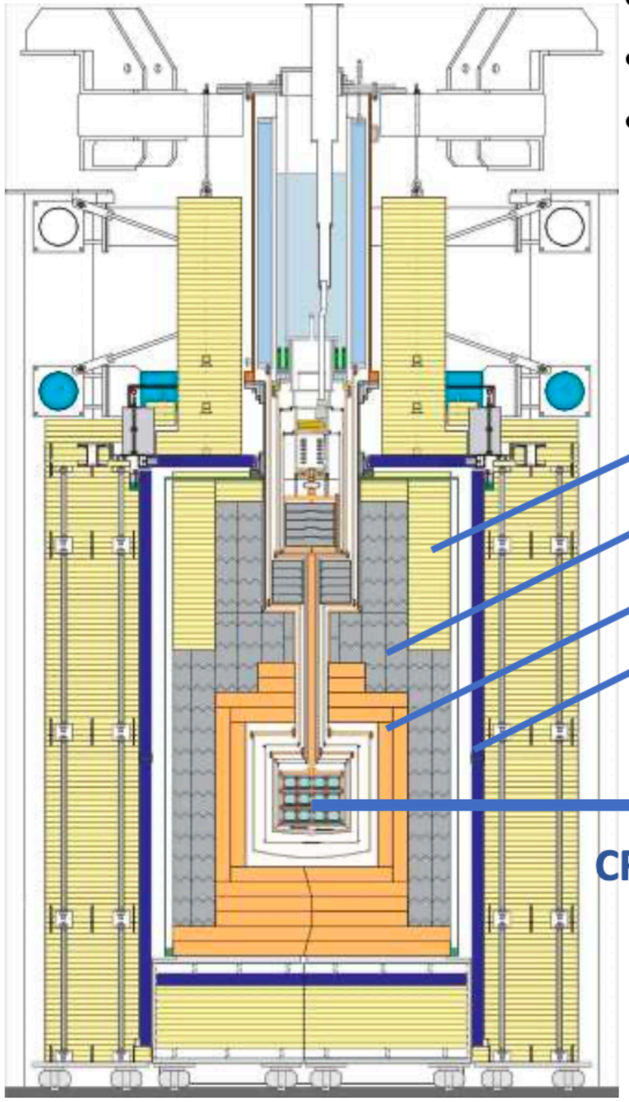
UNIVERSITY OF OXFORD

INFN LNGS
Istituto Nazionale di Fisica Nucleare
Laboratori Nazionali del Gran Sasso

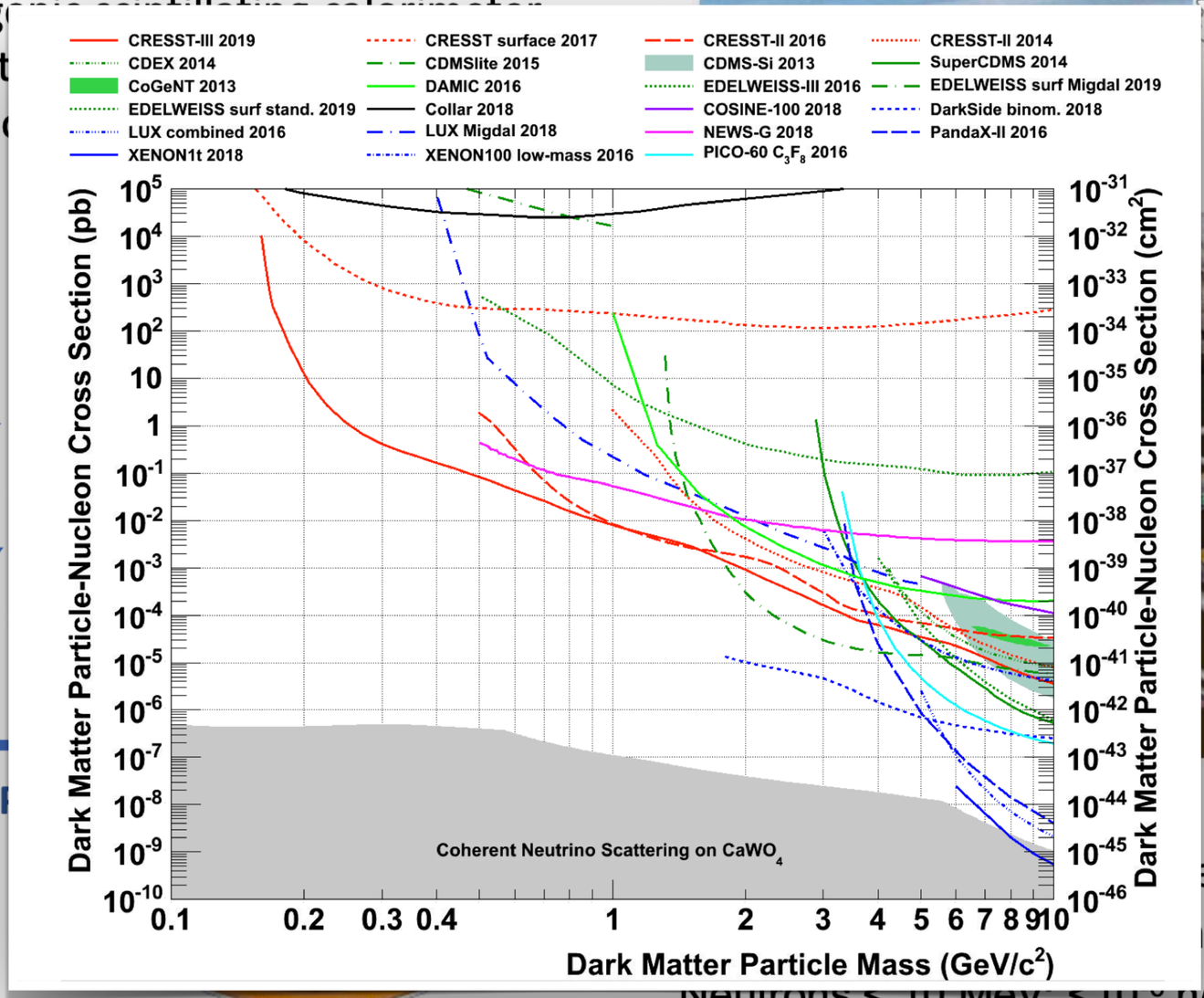
Max-Planck-Institut für Physik
(Werner-Heisenberg-Institut)

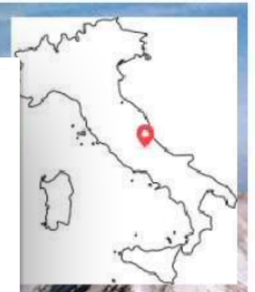
CRESST is located at LNGS (Laboratori Nazionali del Gran Sasso) in Italy

- Cryog
- Target
- Read



CRESST-III





e.

2

Neutrons < 10 MeV: <10 $^{-6}$ n/s/cm^2

COSINUS

~25 scientists

HEPHY
INSTITUTE OF HIGH ENERGY PHYSICS

TU WIEN

MAX-PLANCK-INSTITUT FÜR PHYSIK

INFN
Istituto Nazionale di Fisica Nucleare

HELSINKI INSTITUTE OF PHYSICS

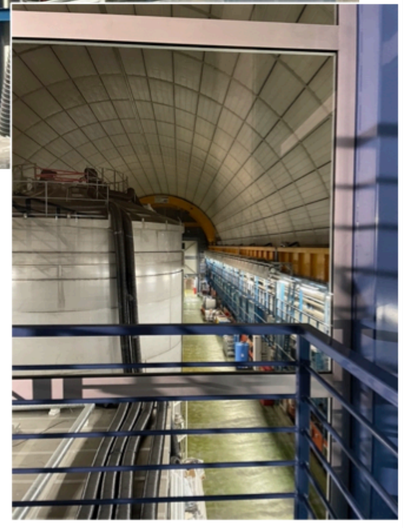
GSSI
GRAN SASSO SCIENCE INSTITUTE
SCHOOL OF ADVANCED STUDIES
Scuola Universitaria Superiore

Since 1928
SICCAS

Recent updates

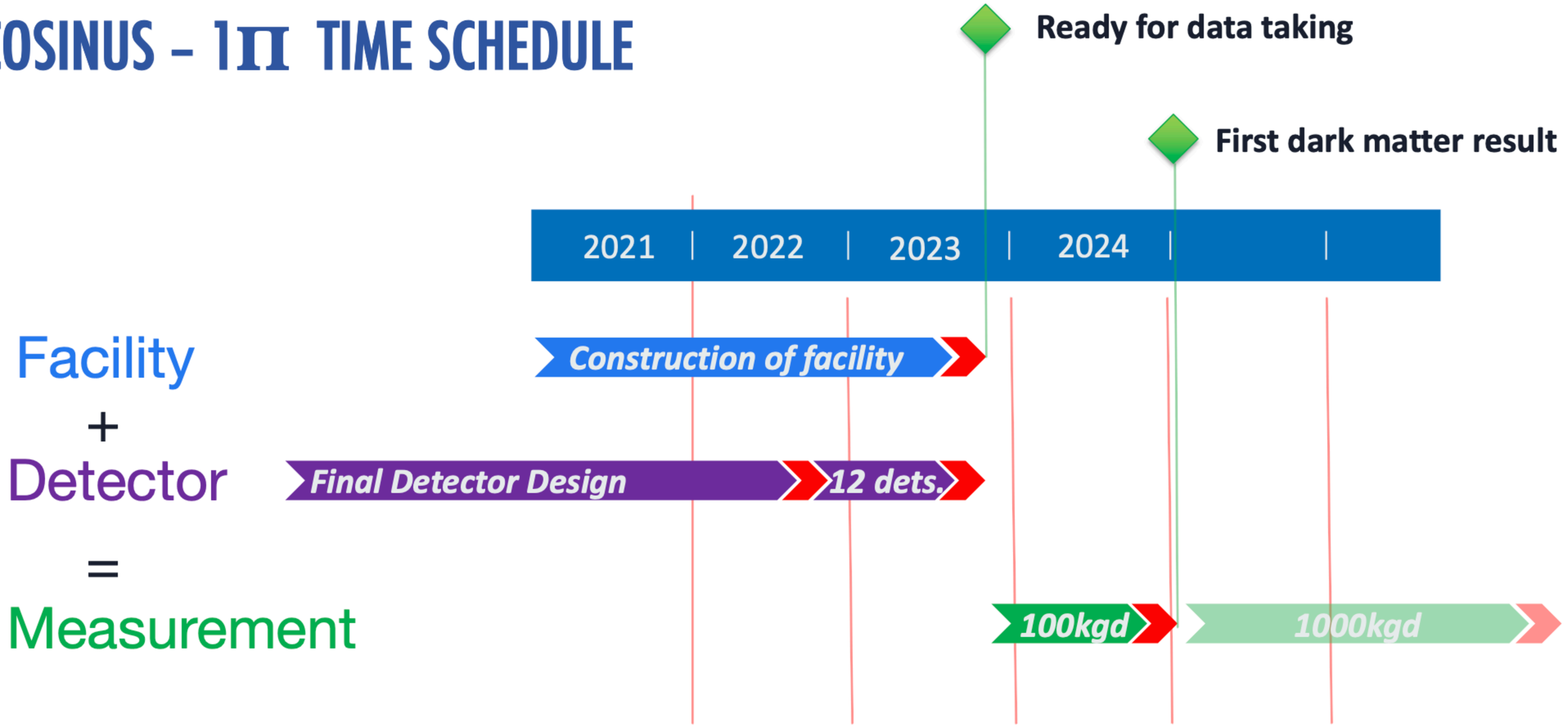
Dec. 2021

April 2022



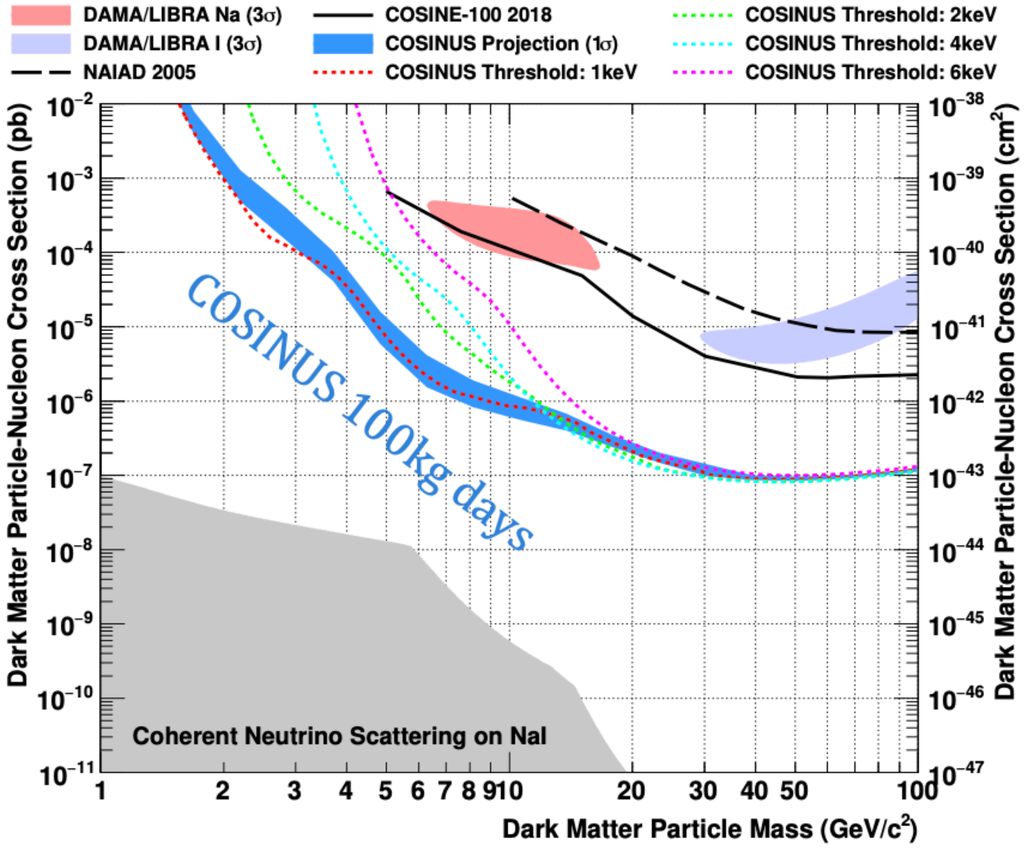
June 2022

COSINUS – 1π TIME SCHEDULE



PHYSICS REACH

Felix Kahlhoefer, FR, et al JCAP05(2018)074



COSINUS – 1π (2022-2025)

Exclude or confirm nuclear recoil origin of DAMA with total rate measurement:

- Independent of dark matter halo
- For any interaction of dark matter with nuclei

COSINUS – 2π (≥2026)

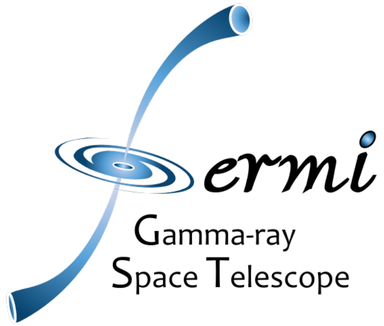
Investigate annual modulation signature with COSINUS

Cosmic Ray Physics

University of Innsbruck

Olaf Reimer, Anita Reimer, et al

- Fermi Large Area Telescope (LAT)
- High Energy Stereoscopic System (H.E.S.S.)
- Cherenkov Telescope Array (CTA)
- Theory and Computational Physics Groups



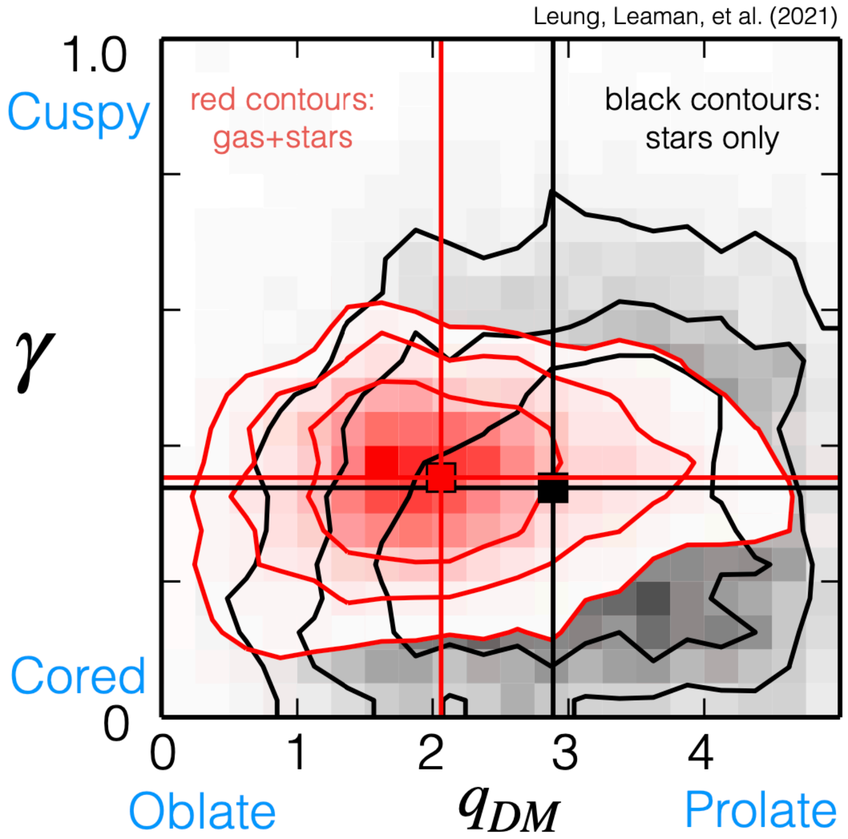
Theory & Simulation

Vienna University

Glen van de Ven (ERC ArcheoDyn), Oliver Hahn (ERC COSMO-SIMS)

e.g.

- New methods are needed to differentiate CDM+feedback from alternative dark matter theories
- **Advanced dynamical models** are providing more robust inferences of local and extragalactic DM distributions
- Combining gas, stellar and globular cluster orbits let us recover **DM density profile *and* flattening**



Theory

HEPHY Vienna

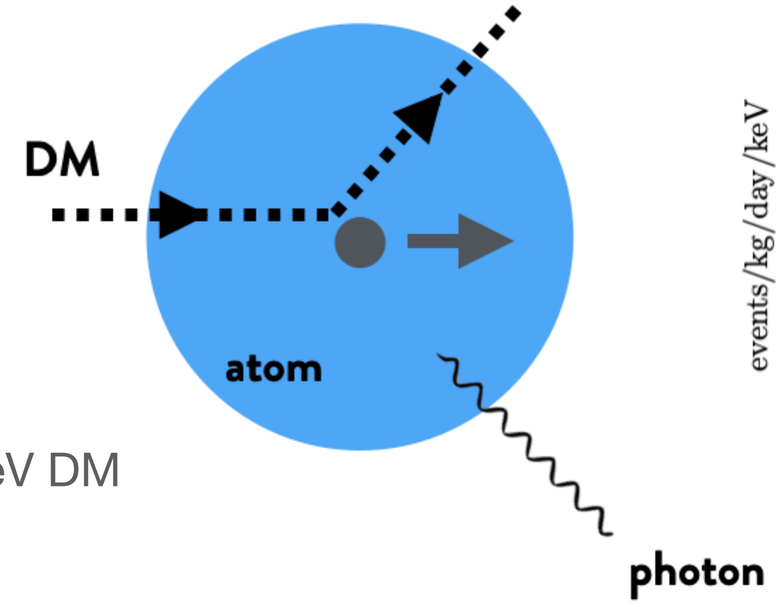
Josef Pradler

Topics include:

direct detection of sub-GeV DM

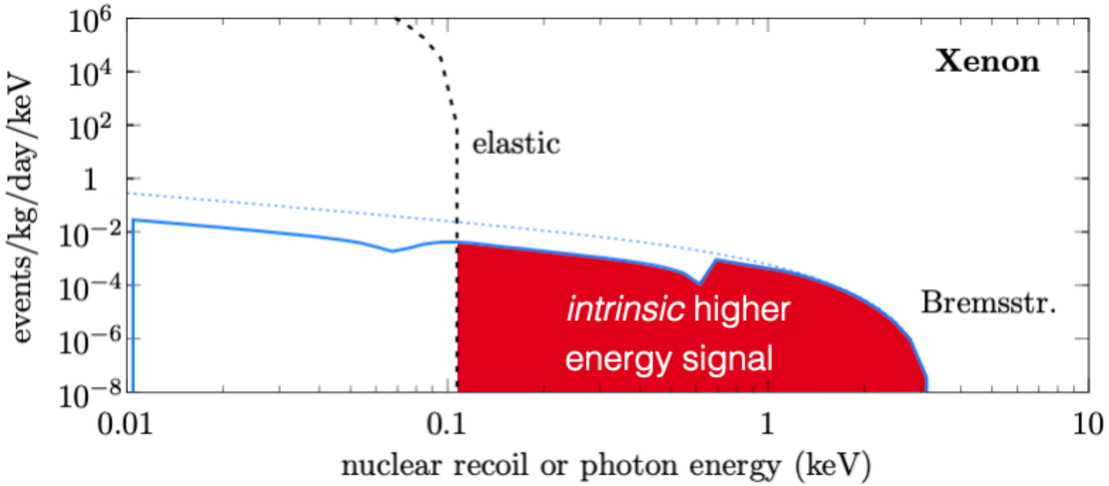
astrophysical implications

cosmological probes
(BBN, 21 cm, …)



“Bremsstrahlung”

Kouvaris, **JP**, Phys.Rev.Lett. 118 (2017)

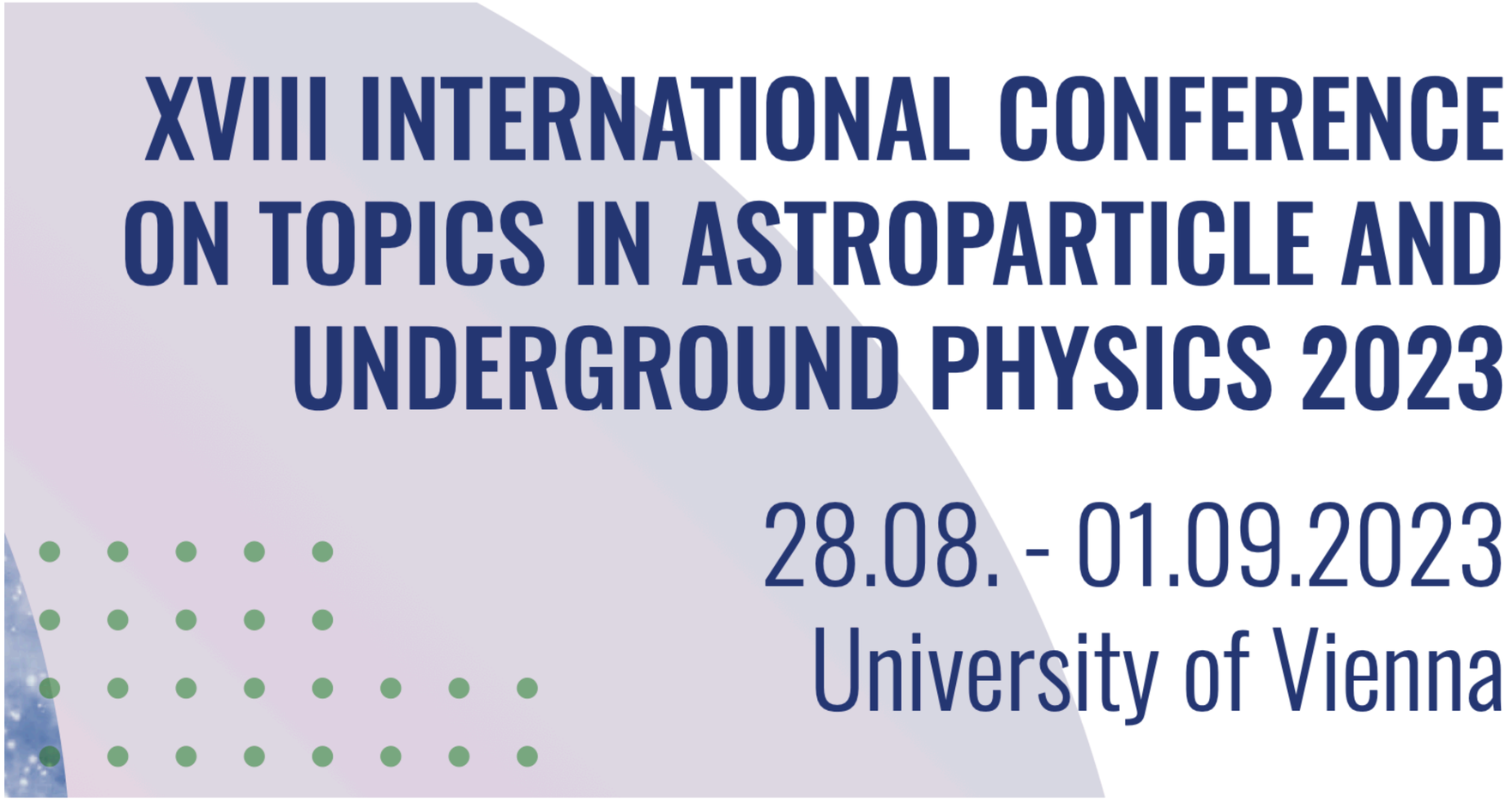


dedicated searches being performed

XENON1T collaboration [Phys.Rev.Lett. 123 (2019)]

LUX collaboration [Phys.Rev.Lett. 122 (2019)]

TAUP coming to Vienna



Hope to see many of you in Vienna in a year!