



CERN AXION SOLAR TELESCOPE

Statusreport to SPSC

Representing the CAST collaboration:

Dieter H.H. Hoffmann

TU-Darmstadt & GSI- Darmstadt

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The CAST Collaboration

(1) Croatia, Zagreb

Ruder Boskovic Institute

M. KRČMAR, A. LJUBIČIĆ, B. LAKIĆ

(2) France, Gif-Sur-Yvette

Centre d'Etudes de Saclay (CEA-Saclay), DAPNIA

S. ANDRIAMONJE, St. AUNE, A. DELBART, E. FERRER
RIBAS, I. GIOMATARIS, I.G. IRASTORZA,

(3) Germany, Darmstadt

Technische Universität Darmstadt, Institut für Kernphysik

T. DAFNI, D. HOFFMANN, M. Kanapathipillai, M.
MUTTERER, H. RIEGE, Y. SEMERTZIDIS

(4) Germany, Frankfurt

Applied Physics

V. ARSOV, J. JACOBY

(5) Germany, Freiburg

Albert-Ludwigs-Universität Freiburg

H. FISCHER, J. FRANZ, F.-H. HEINSIUS, D. KANG, K.
KÖNIGSMANN

(6) Germany, Garching

*Max-Planck-Gesellschaft (MPG), Max-Planck-Institut für
Extraterrestrische Physik*

H. BRÄUNINGER, J. ENGLHAUSER, P. Friedrich, R.
Hartmann, M. Kuster

(7) Germany, Muenchen

*Max-Planck-Institut für Physik, Werner-Heisenberg-
Institut*

R. KOTTHAUS, G. LUTZ, G. RAFFELT

(8) Greece, Athens

*National Center for Scientific Research "Demokritos"
(NRCPS)*

G. FANOURLAKIS, Th. GERALIS, K. Kousouris, K.
ZACHARIADOU

(9) Greece, Thessaloniki

Aristotle University of Thessaloniki

Ch. ELEFThERIADIS, A. LIOLIOS, A. NIKOLAIDIS, I.
SAVVIDIS, K. ZIOUTAS

(10) Italy, Pisa

Scuola Normale Superiore (SNS)

L. DiLella

(11) Russia, Moskva

*Russian Academy of Sciences, Institute for Nuclear
Research (INR)*

S. GNINENKO, N. GOLOUBEV

(12) Spain, Zaragoza

*Universidad de Zaragoza, Facultad de Ciencias,
Instituto de Física Nuclear y Altas Energías*

B. BELTRAN, J. CARMONA, S. CEBRIAN, GI. LUZON, A.
MORALES, J. MORALES, A. ORTIZ DE SOLORZANO, J.
Ruz, M. SARSA, J. VILLAR

(13) Switzerland, Geneve

European Organization for Nuclear Research (CERN)

K. BARTH, M. DAVENPORT, R. DE OLIVEIRA, M.
DIMARCO, F. FORMENTI, A. MCDONALD, Th.
PAPAEVANGELOU, A. PLACCI, L. STEWART, B.
VULLIERME, L. WALCKIERS

(14) United States of America, Chicago, II

University of Chicago, Enrico Fermi Institute

J. COLLAR, D. MILLER, J. VIEIRA

(15) United States of America, Columbia, Sc

*University of South Carolina, Department of Physics
and Astronomy*

F. AVIGNONE, R. CRESWICK, H. FARACH



Outline



[Haw]

-Solar Axions

-CAST :

- Status

Magnet, sun tracking

-Detectors:

TPC

Micromegas

X-ray Telescope and CCD

-Outlook



Axions

α

pseudoscalar

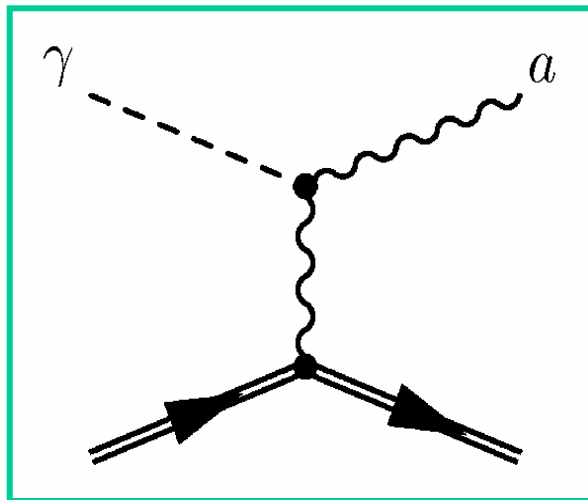
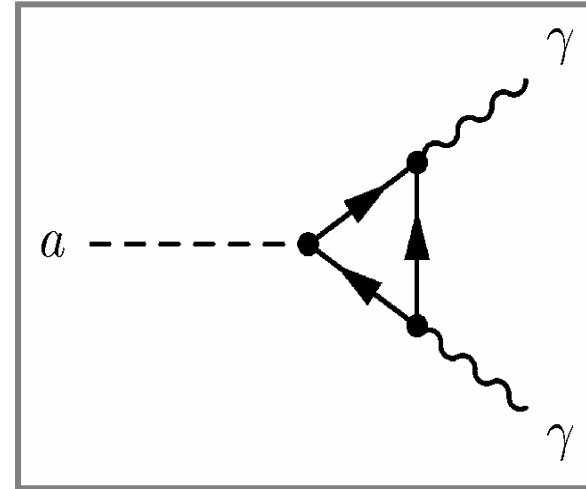
neutral

practically stable

phenomenology driven by the breaking scale f_a and the specific axion model

Couples to photon

$$\mathcal{L}_{\alpha\gamma} = g_{\alpha\gamma}(\mathbf{E}\cdot\mathbf{B}) a$$



Primakoff (1951) [$\pi^0 \rightarrow \gamma\gamma$]

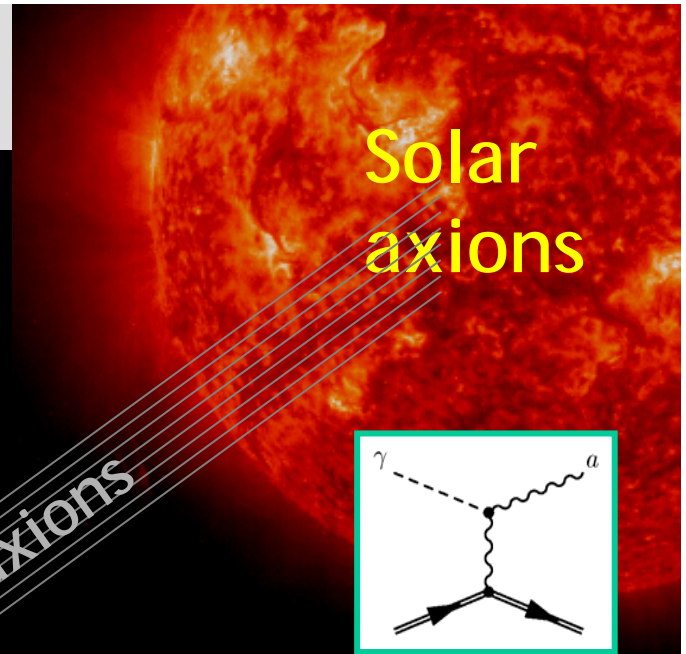
PRIMAKOFF EFFECT

Any scalar or pseudoscalar particles:

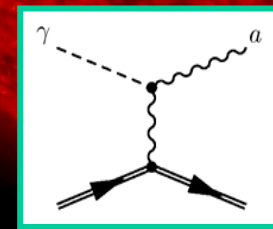
axion-like particles



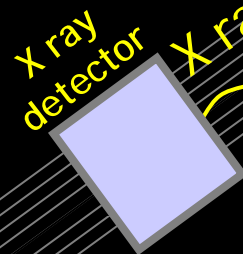
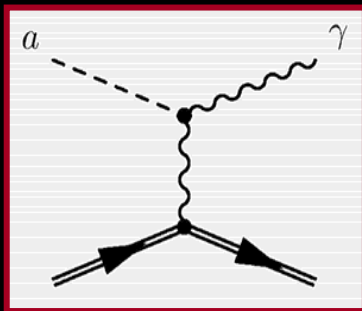
Principle of detection



Solar axions



AXION PHOTON CONVERSION



Transverse magnetic field (B)

$$P_{a\gamma} = 1.8 \times 10^{-17} \left(\frac{B}{8.4T}\right)^2 \left(\frac{L}{10m}\right)^2 (g_{a\gamma\gamma} \times 10^{10} \text{GeV}^{-1})^2 |\mathcal{M}|^2,$$

COHERENCE

1



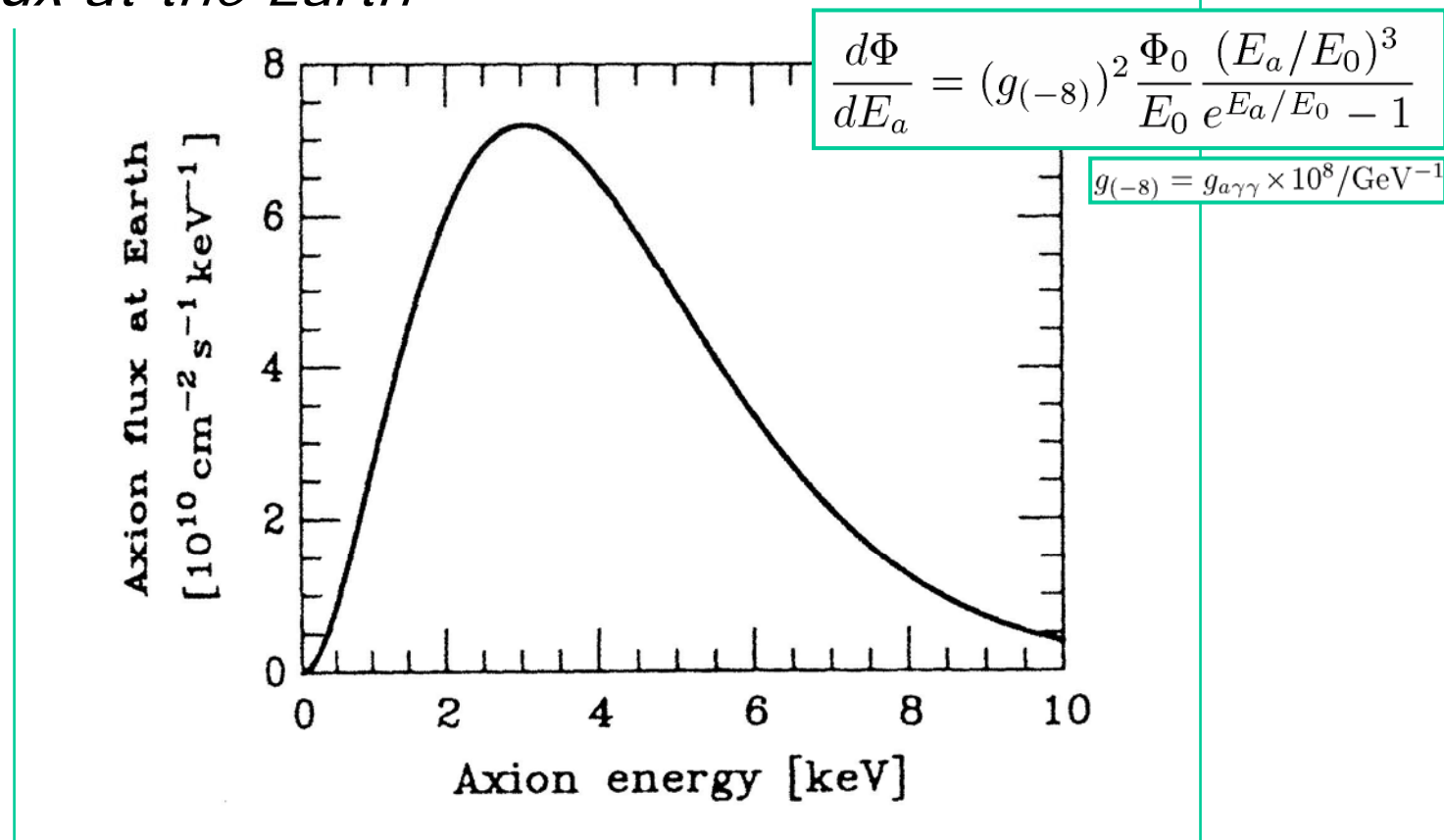
Solar Axion Spectrum



PRIMAKOFF EFFECT

Stellar interior → the Sun!! → Solar Axions

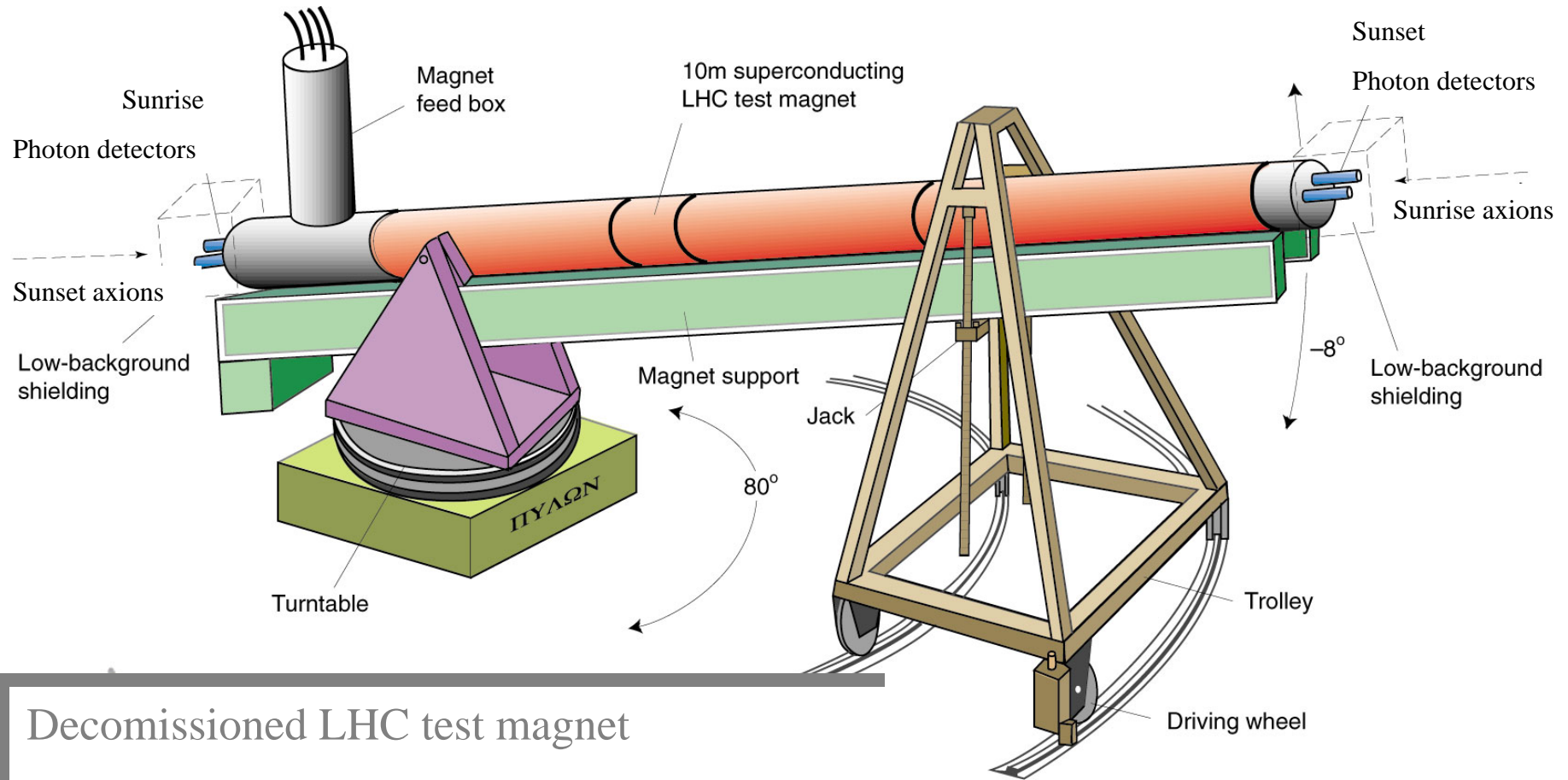
Flux at the Earth



[K. van Bibber et al., 1989]



Cern Axion Solar Telescope



Decommissioned LHC test magnet

Rotating platform

3 X-ray detectors

X-ray Focusing Device



CAST : Magnet



$L = 10 \text{ m}, B = 9 \text{ T}$

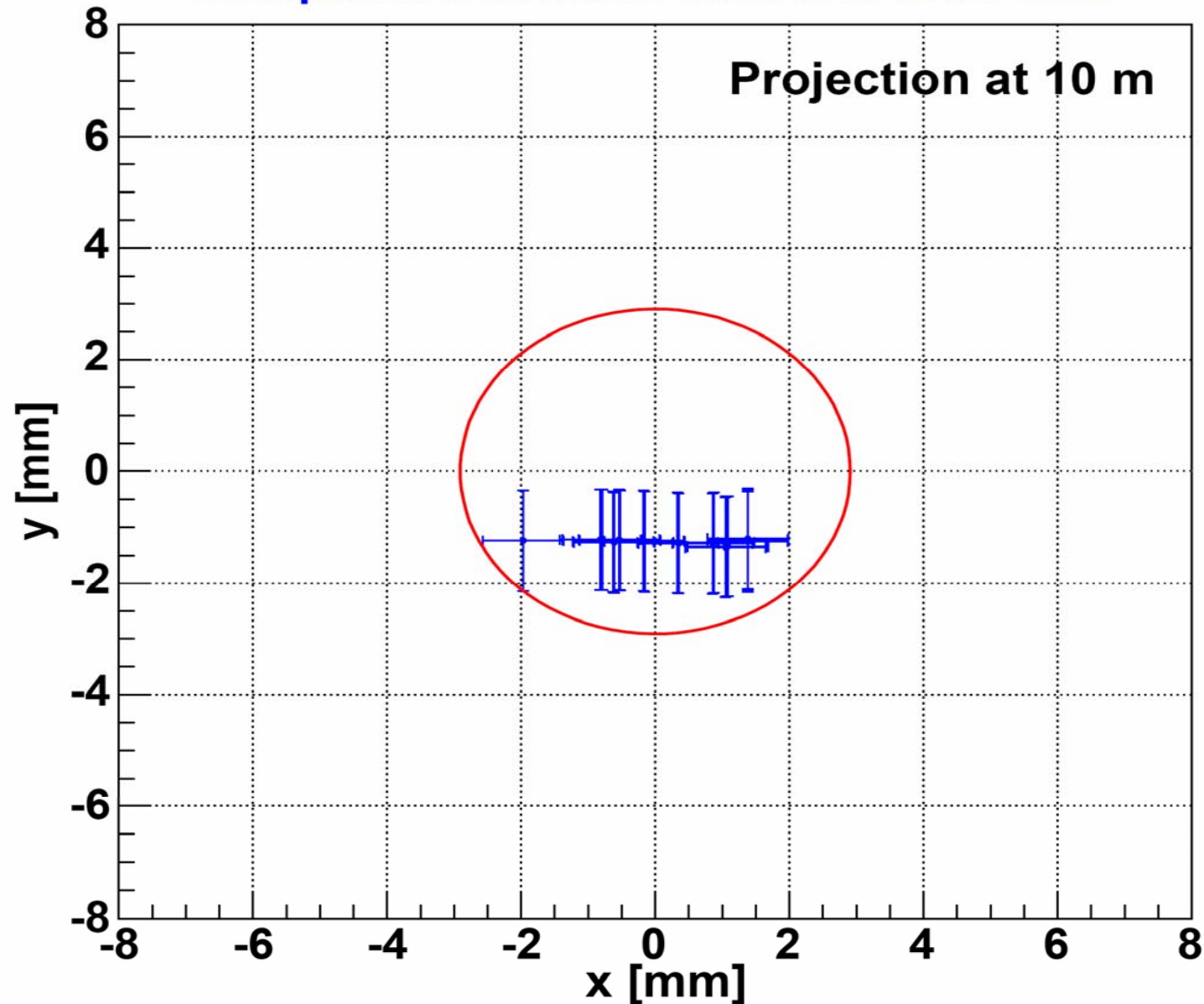
→ *100 times better than previous exp.*





Grid measurements after magnet loading

Comparison between 2002 and 2004 GRID



Angular encoders





Magnet, sun tracking

*Looking at
sunrise*

Tracking System:

Calibrated and correlated with
celestial coordinates



Twice a year (September&March)
we can film the Sun through the
window