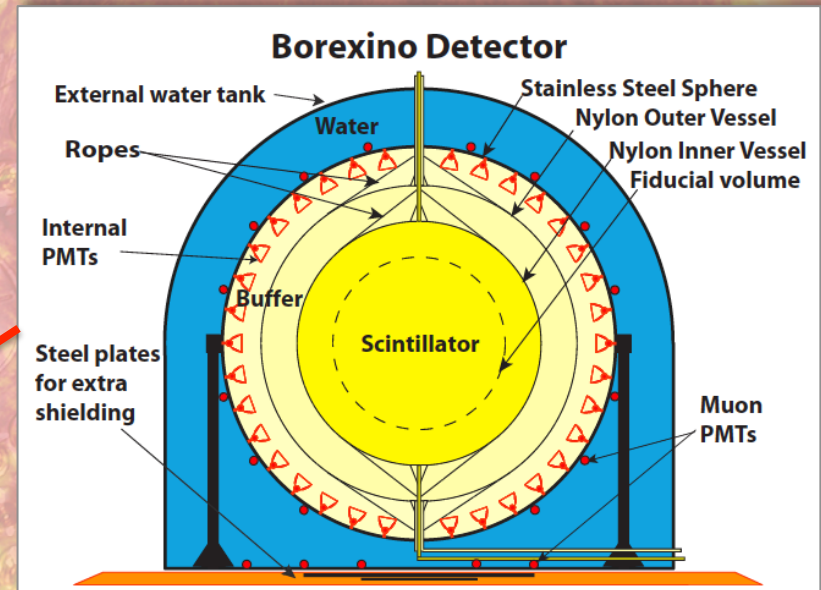
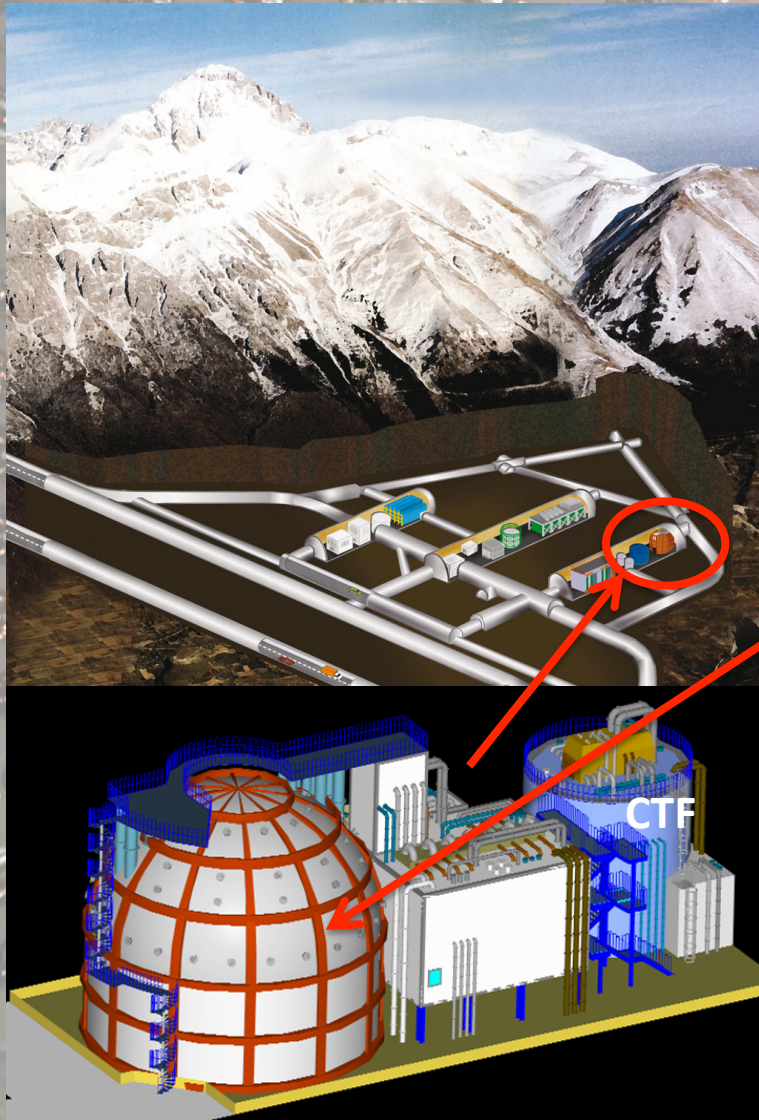


BOREXINO: Erste komplette spektroskopische Messung solarer Neutrinos

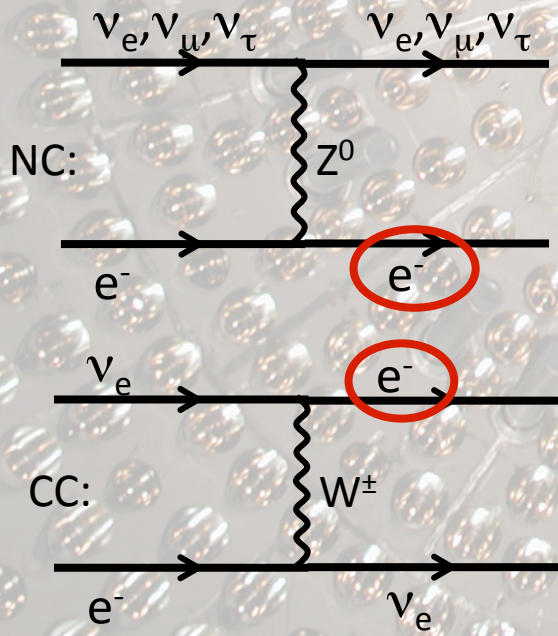
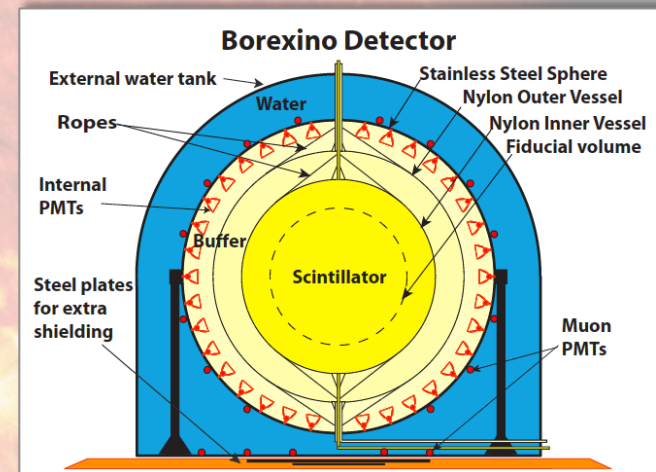
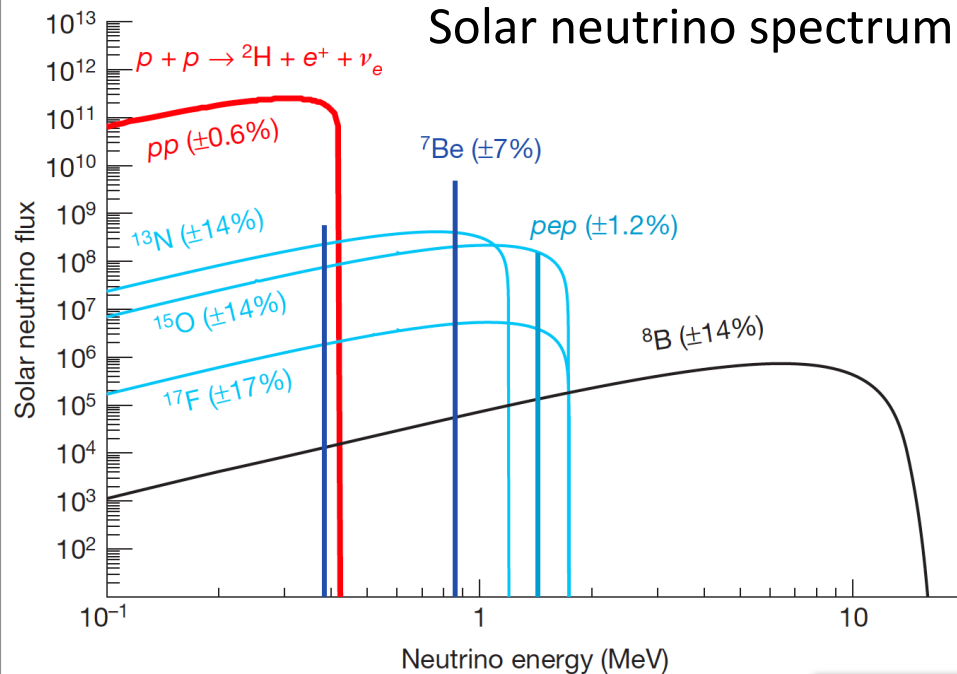
Astroteilchenphysik in Deutschland
Status und Perspektiven
30.9.-1.10.2014 am KIT

Stefan Schönert
Physik-Department E15
Chair for experimental physics and astroparticle physics
TU München

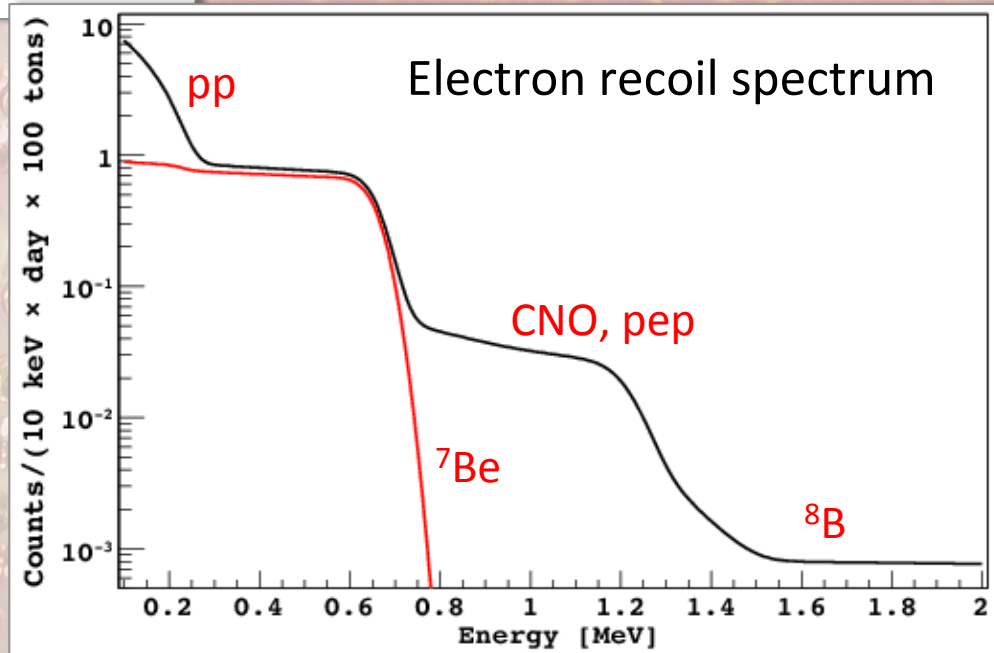
Borexino@LNGS: Spectroscopy of low-energy solar neutrinos and neutrinos from other sources

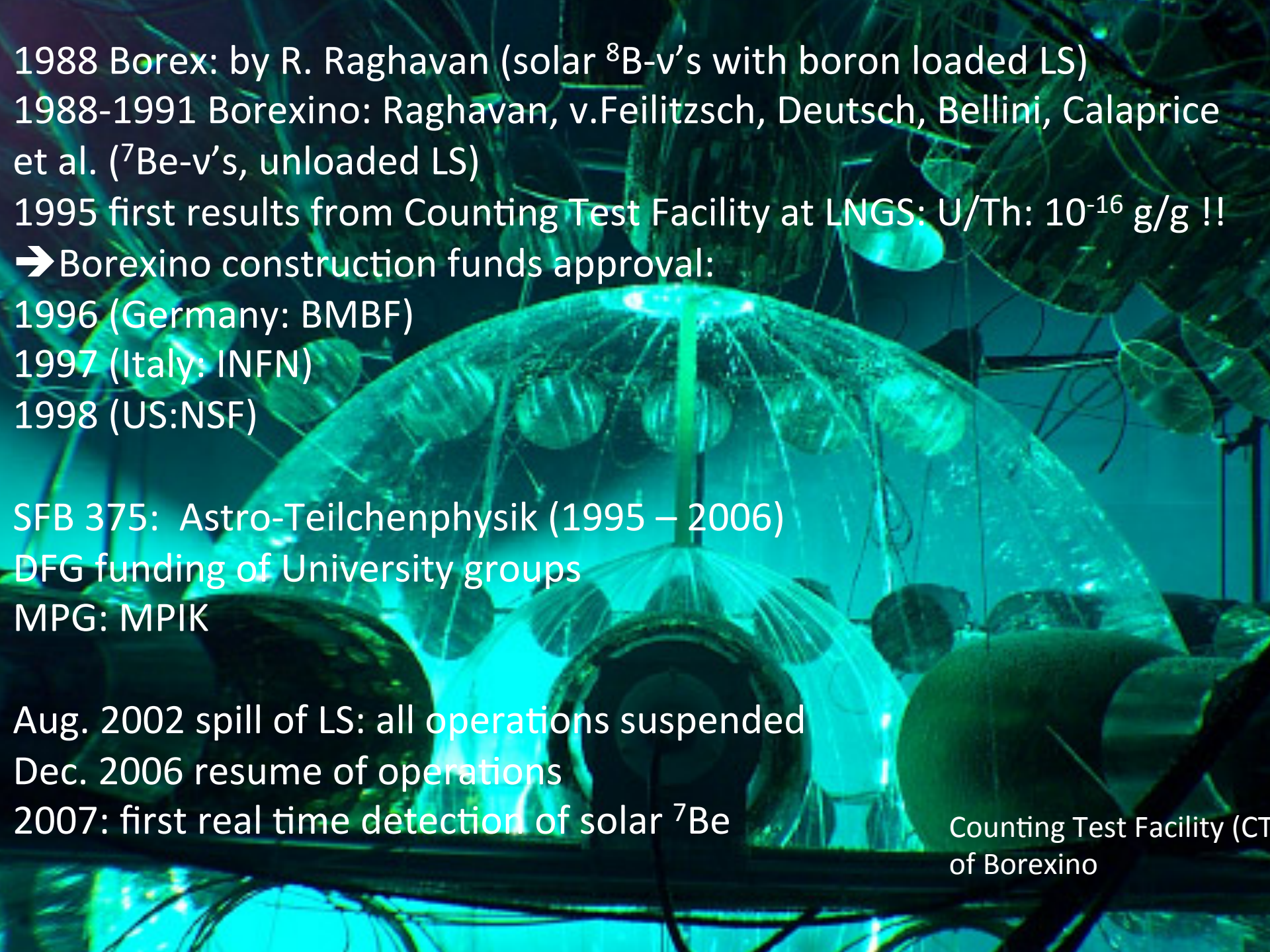


Solar neutrino spectrum



Electron recoil spectrum





1988 Borex: by R. Raghavan (solar ^8B - ν 's with boron loaded LS)
1988-1991 Borexino: Raghavan, v.Feilitzsch, Deutsch, Bellini, Calaprice
et al. (^7Be - ν 's, unloaded LS)
1995 first results from Counting Test Facility at LNGS: U/Th: 10^{-16} g/g !!
→ Borexino construction funds approval:
1996 (Germany: BMBF)
1997 (Italy: INFN)
1998 (US: NSF)

SFB 375: Astro-Teilchenphysik (1995 – 2006)
DFG funding of University groups
MPG: MPIK

Aug. 2002 spill of LS: all operations suspended
Dec. 2006 resume of operations
2007: first real time detection of solar ^7Be

Counting Test Facility (CTF)
of Borexino

Groups from Germany



Milano



Heidelberg



Hamburg



Mainz



Gran Sasso



Perugia



Genova



Napoli



TU Dresden



Jagiellonian
Kraków



the Borexino Collaboration



Virginia Tech



Houston



Paris



Moscow



JINR
Dubna



Los Angeles



Princeton



UMass
Amherst

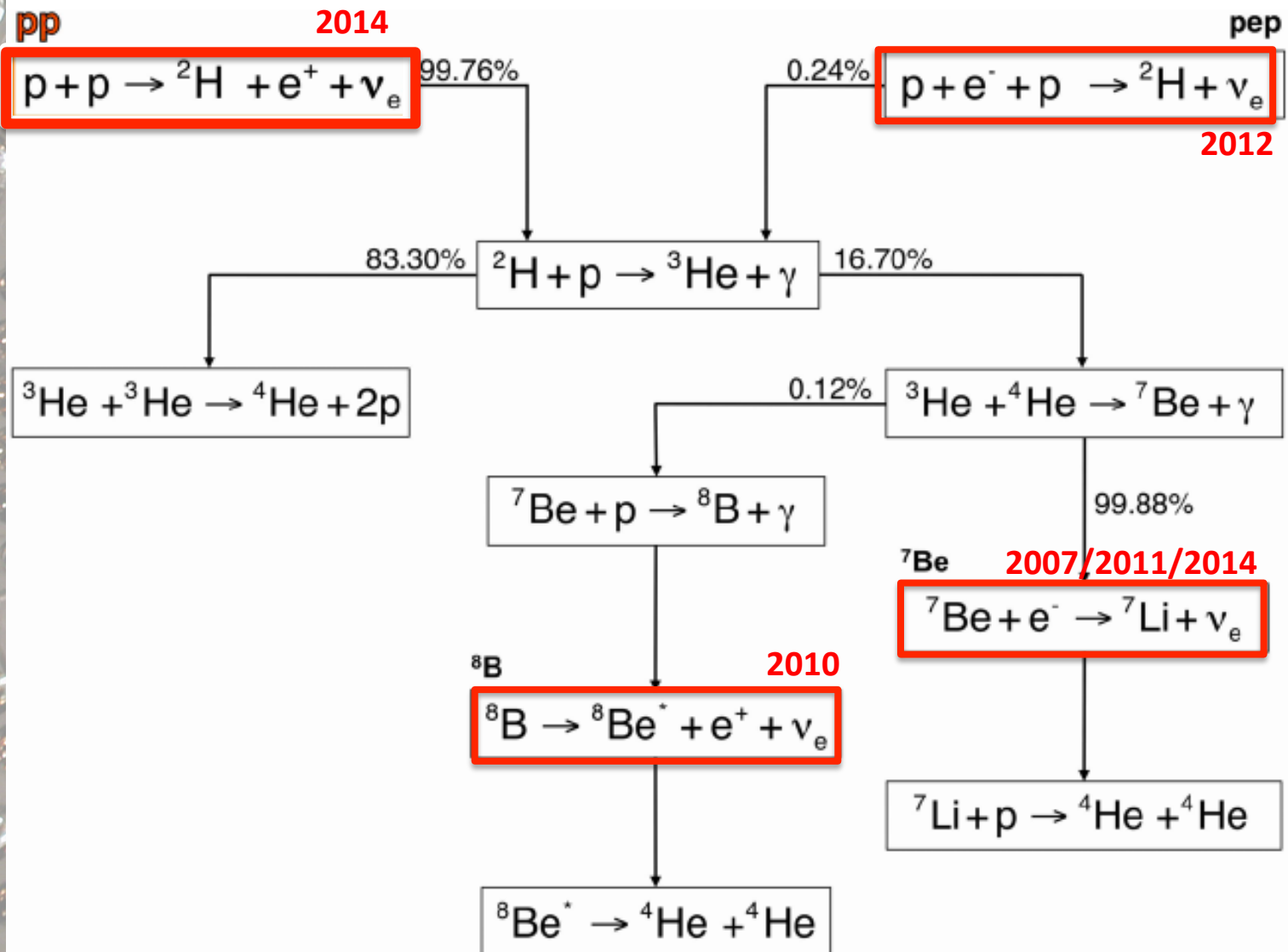


St. Petersburg

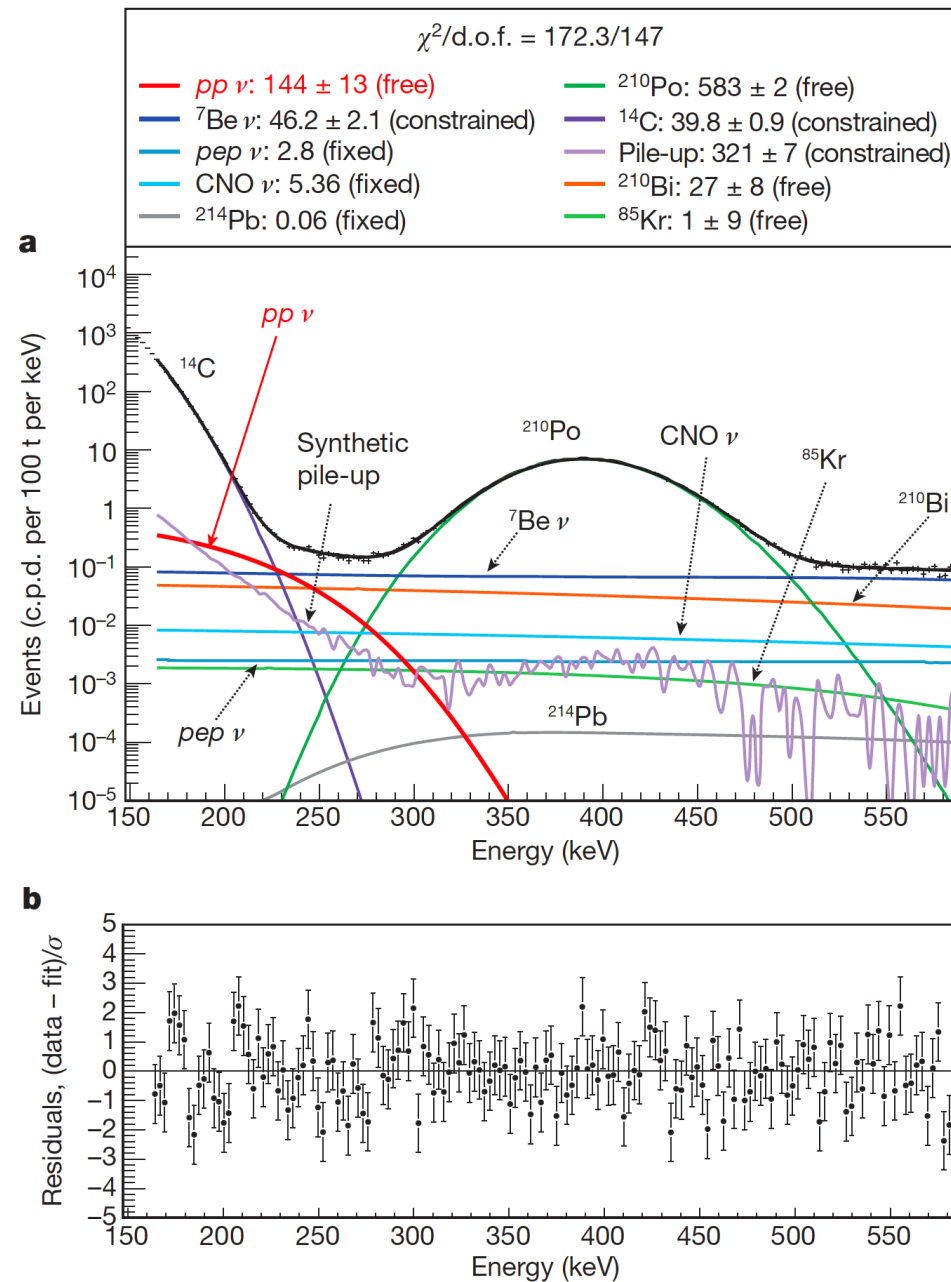


Kurchatov
Moscow

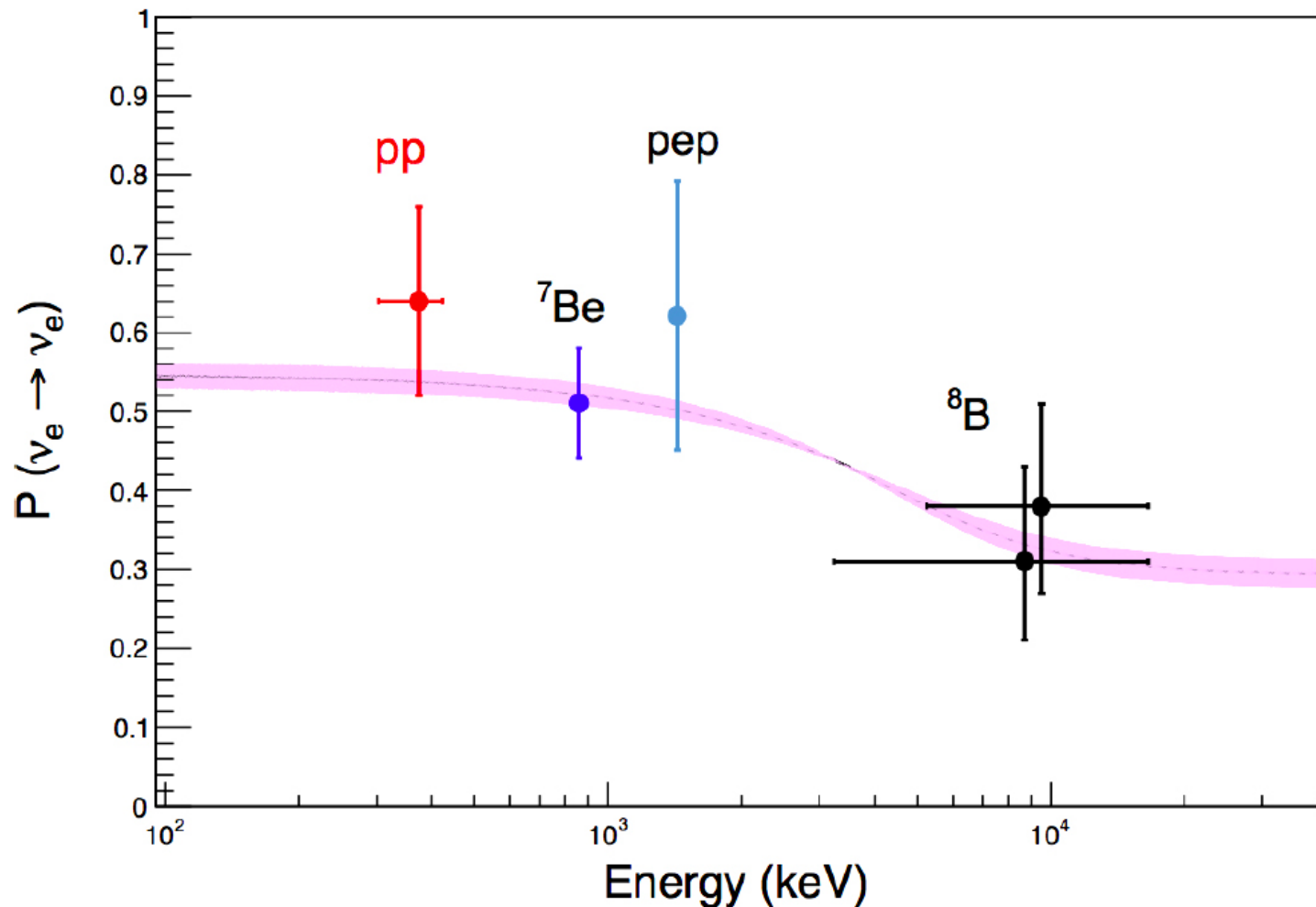
Measurement of solar neutrinos from all branches from pp-cycle



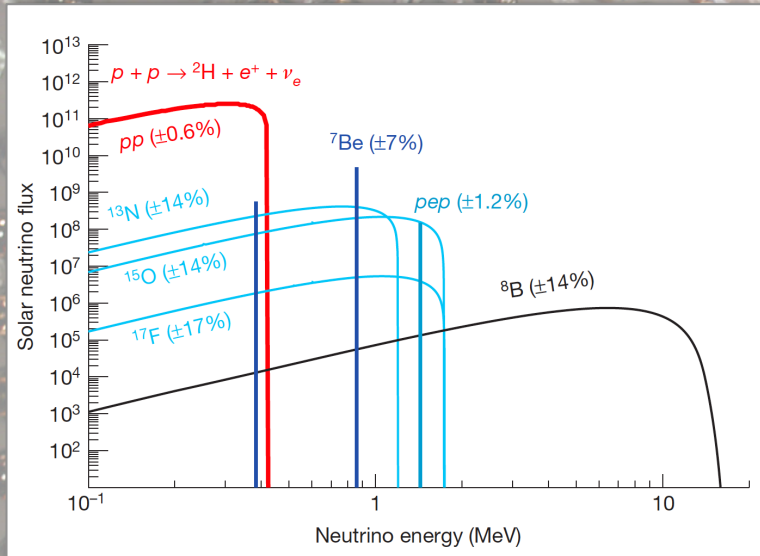
Details of pp-measurment: M. Wurm



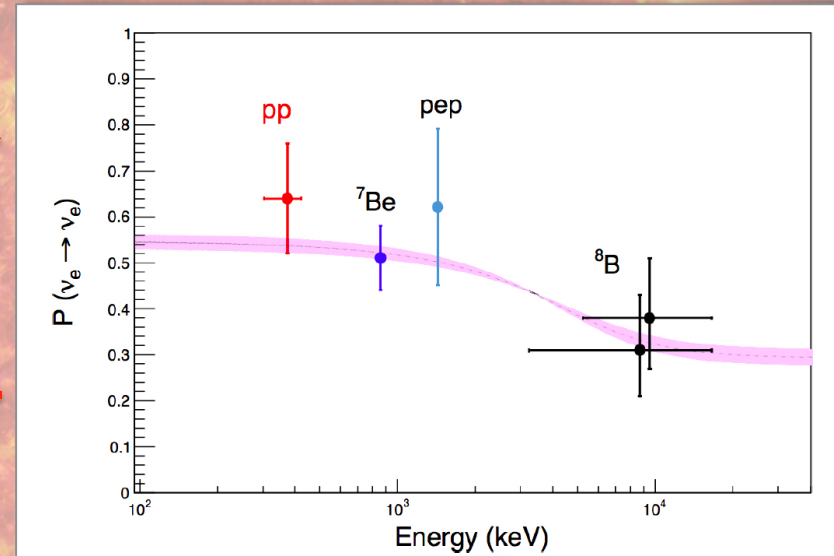
First direct spectral measurement of solar **pp**-neutrinos completes ${}^7\text{Be}$, pep and ${}^8\text{B}$ measurements with Borexino



Experimental measurement of
complete solar neutrino spectrum
(pp-cycle)



Vacuum oscillations and resonant matter
flavor conversion (MSW-effect)



Future:

SOX: sterile neutrino search: M. Agostini's talk

CNO neutrino improved constraints (or measurement)

${}^8\text{B}$ analysis with full data set

Supernova – if lucky!



Fakultät für Physik



Excellence Cluster Universe

Technische Universität München



Nov. 7, TUM

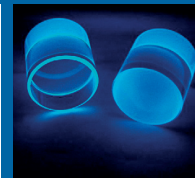
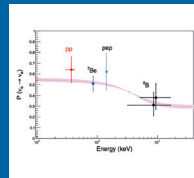
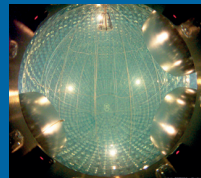
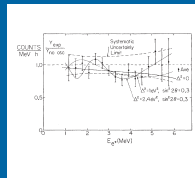
Invitation

Symposium on selected Topics in Astroparticle Physics

In celebration of the 70th birthday of
Prof. Franz von Feilitzsch

Friday, November 7th, 2014, 10 am
Institute for Advanced Study
Lichtenbergstr. 2a,
Garching

For further information on this event:
Technische Universität München
Fakultät für Physik
Tel.: +49 89 289 12522
Fax: +49 89 289 12680
e15office@ph.tum.de



Program

9:00 Coffee

10:00 Prof. Stefan Schönert (TUM):
Welcome

10:10 Prof. Marco Pallavicini (INFN & Univ. Genova):
Solar neutrino spectroscopy with Borexino

10:50 Dr. Thierry Lasserre (CEA Saclay):
Reactor neutrino oscillations

11:30 Prof. Michael Wurm (Univ. Mainz):
The quest for sterile neutrinos

12:10 Lunch

14:00 Prof. Josef Jochum (Univ. Tübingen):
Dark matter search with cryogenic detectors

14:40 Dr. Hans-Thomas Janka (MPA):
Supernovae and Neutrinos

15:20 Coffee

15:50 Prof. Wolfgang Hillebrandt (MPA):
Outcome of the SFB Astroparticle Physics

16:30 Prof. Lothar Oberauer (TUM):
Detector development at E15 - the legacy of Franz von Feilitzsch

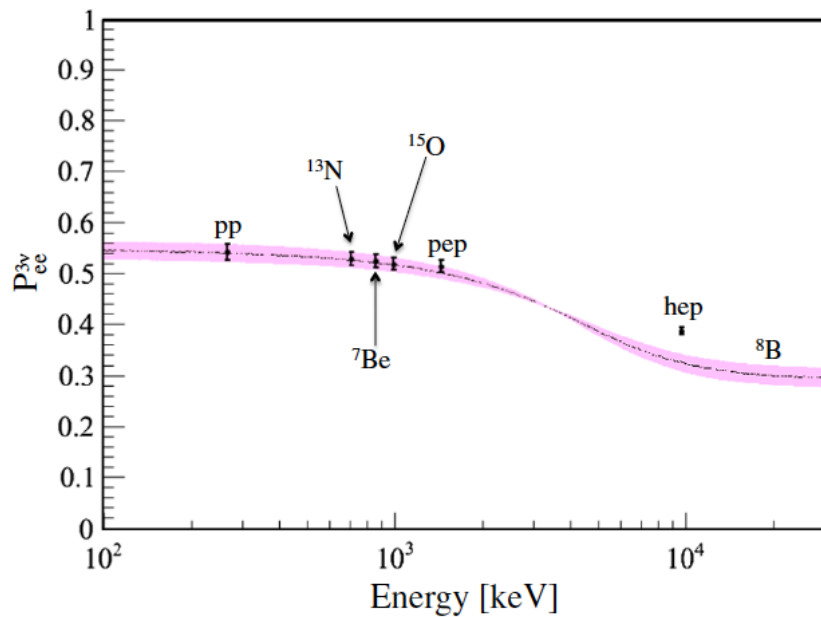
18:00 Bayerische Brotzeit

- [Neutrinos from the primary proton-proton fusion process in the Sun](#)
- Nature 512, 383-386 (28 August 2014) [doi:[10.1038/nature13702](#)]
- [Final results of Borexino phase-I on low-energy solar neutrino spectroscopy \(preprint on arXiv\)](#)
- Phys. Rev. D 89:11 (2014 Jun 25), pp. 112007.1-112007.68 [doi:[10.1103/PhysRevD.89.112007](#)]
- [New limits on heavy sterile neutrino mixing in \$^8\text{B}\$ decay obtained with the Borexino detector \(preprint on arXiv\)](#)
- Phys. Rev. D 88, 072010 (2013) [doi:[10.1103/PhysRevD.88.072010](#)]
- [Cosmogenic Backgrounds in Borexino at 3800 m water-equivalent depth \(preprint on arXiv\)](#)
- Journal of Cosmology and Astroparticle Physics, Volume 2013, August 2013 [doi:[10.1088/1475-7516/2013/08/049](#)]
- [Lifetime measurements of \$^{214}\text{Po}\$ and \$^{212}\text{Po}\$ with the CTF liquid scintillator detector at LNGS \(preprint on arXiv\)](#)
- The European Physical Journal A, 49:92, July 2013 [doi:[10.1140/epja/i2013-13092-9](#)]
- [Measurement of geo-neutrinos from 1353 days of Borexino \(preprint on arXiv\)](#)
- Physics Letters B, April 2013 [doi:[10.1016/j.physletb.2013.04.030](#)]
- [Measurement of CNGS muon neutrino speed with Borexino \(preprint on arXiv\)](#)
- Physics Letters B, Volume 716, Issues 3–5, 2 October 2012, Pages 401–405 [doi:[10.1016/j.physletb.2012.08.052](#)]
- [Borexino calibrations: hardware, methods, and results \(preprint on arXiv\)](#)
- JINST 7:P10018, October 2012 [doi:[10.1088/1748-0221/7/10/P10018](#)]
- [Cosmic-muon flux and annual modulation in Borexino at 3800 m water-equivalent depth \(preprint on arXiv\)](#)
- Journal of Cosmology and Astroparticle Physics Volume 2012 May 2012 [doi:[10.1088/1475-7516/2012/05/015](#)]
- [Search for solar axions produced in the \$p\(d,3\text{He}\)\text{A}\$ reaction with Borexino detector \(preprint on arXiv\)](#)
- Phys. Rev. D, Volume 85, Issue 9 (2012) [doi:[10.1103/PhysRevD.85.092003](#)]

- [First Evidence of pep Solar Neutrinos by Direct Detection in Borexino \(preprint on arXiv\)](#)
- Phys. Rev. Lett. Volume 108, Issue 5, 051302 (2012) [doi:[10.1103/PhysRevLett.108.051302](#)]
- [Absence of a day–night asymmetry in the \$^7\text{Be}\$ solar neutrino rate in Borexino \(preprint on arXiv\)](#)
- Physics Letters B Volume 707, Issue 1, 16 January 2012, Pages 22–26 [doi:[10.1016/j.physletb.2011.11.025](#)]
- [Precision Measurement of the \$^7\text{Be}\$ Solar Neutrino Interaction Rate in Borexino \(preprint on arXiv\)](#)
- Phys. Rev. Lett. 107, 141302 (2011) [doi:[10.1103/PhysRevLett.107.141302](#)]
- [Muon and cosmogenic neutron detection in Borexino \(preprint on arXiv\)](#)
- JINST 6:P05005, 2011 [doi:[10.1088/1748-0221/6/05/P05005](#)]
- [Study of solar and other unknown anti-neutrino fluxes with Borexino at LNGS \(preprint on arXiv\)](#)
- Physics Letters B Volume 696, Issue 3, 31 January 2011, Pages 191-196 [doi:[10.1016/j.physletb.2010.12.030](#)]
- [Measurement of the solar \$^8\text{B}\$ neutrino rate with a liquid scintillator target and 3 MeV energy threshold in the Borexino detector \(external links: published version \[DOI link\]; preprint on arXiv\)](#)
- Phys. Rev. D Volume 82, Issue 3 (033006), 05 August 2010
- [Observation of Geo-Neutrinos \(external links: published version; preprint on arXiv\)](#)
- Physics Letters B Volume 687, Issues 4-5, 19 April 2010, Pages 299-304
- [New experimental limits on the Pauli-forbidden transitions in \$^{12}\text{C}\$ nuclei obtained with 485 days Borexino data \(external links: published version; preprint on arXiv\)](#)
- Physical Review C Volume 81, Issue 3, 034317 – March 2010
- [The liquid handling systems for the Borexino solar neutrino detector \(external links: published version\)](#)
- Nuclear Instruments and Methods in Physics Research A Volume 609, Issue 1, 1 October 2009, Pages 58-78.
- [The Borexino detector at the Laboratori Nazionali del Gran Sasso \(external links: published version; preprint on arXiv\)](#)
- Nuclear Instruments and Methods in Physics Research A Volume 600, Issue 3, 11 March 2009, Pages 568-593.

- [Direct Measurement of the \$7\text{Be}\$ Solar Neutrino Flux with 192 Days of Borexino Data \(external links: published version; preprint on arXiv\)](#)
- **Physical Review Letters Vol.101, No.9 (August 2008).**
- [Search for solar axions emitted in the M1-transition of \$7\text{Li}^*\$ with Borexino CTF \(external links: published version\)](#)
- European Physical Journal C 54, 61-72 (2008).
- [Study of phenylxylylethane \(PXE\) as scintillator for low energy neutrino experiments \(external links: doi:10.1016/j.nima.2007.10.045\)](#)
- Nuclear Instruments and Methods in Physics Research A 585, 48-60 (2008).
- [Pulse-shape discrimination with the Counting Test Facility \(external links: doi:10.1016/j.nima.2007.09.036\)](#)
- Nuclear Instruments and Methods in Physics Research A 584, 98-113 (2008).
- [First real time detection of \$7\text{Be}\$ solar neutrinos by Borexino \(external links: doi:10.1016/j.physletb.2007.09.054; preprint on arXiv\)](#)
- **Physics Letters B 658, 101-108 (2008).**

Theoretical predictions



Experimental results prior to direct pp-measurement

