

PRIN 2022 “PANTHEON”
Stato Unita', Universita' dell'Aquila

F.L. Villante

Partecipanti

- F. L. Villante (PO)
- Z. Bereziani (PO)
- F. Capozzi (RTB) → Inserito dopo la approvazione del progetto

Unit	Peopl e	A1 (stipendi)	A2 (contratti)	B (60% A1+A2)	C (attrezz. rendic.)	E (missioni rend.)	TOT A2+B+C+E (cofinanz.)	TOT + A1	Overhead che grava su B	Contratto che grava su B	B "netto"	Bnetto+C+E	A persona
INFN	5	19.300,00	41.000,00	36.180,00	2.780,00	14.500,00	94.460,00	113.760,00	3.618,00	9.400,00	23.162,00	40.442,00	8.088,40
BA	5	39.000,00	0,00	23.400,00	6.000,00	15.500,00	44.900,00	83.900,00	8.367,00	0	15.033,00	36.533,00	7.306,60
NA	4	31.500,00	0,00	18.900,00	5.000,00	12.000,00	35.900,00	67.400,00	4.290,00	0	14.610,00	31.610,00	7.902,50
RM1	2	15.900,00	0,00	9.540,00	2.400,00	6.000,00	17.940,00	33.840,00	1.076,40	0	8.463,60	16.863,60	8.431,80
AQ	3	14.000,00	0,00	8.400,00	0,00	8.400,00	16.800,00	30.800,00	(Da definire)	0	8.400,00	16.800,00	8.400,00
TOT	18	119.700,00	41.000,00	96.420,00	16.180,00	56.400,00	210.000,00	329.700,00	17.351,40	9.400,00	69.668,60	142.248,60	7.902,70

Papers during 1st year

Published:

“Towards understanding fermion masses and mixings”

Z. Berezhiani, B. Belfatto

Int.J.Mod.Phys.A 39 (2024) 09n10, 2441010

Preprints:

“Solar fusion III: New data and theory for hydrogen-burning stars”

B. Acharya et al. (**F.L. Villante**),

submitted to Phys. Rept. (referee comments received)

e-Print: 2405.06470 [astro-ph.SR]

“Renormalization group flows and emergent symmetries”

Z. Berezhiani, M. Di Giambattista, A. Maiezza, A. Kobakhidze

e-Print: 2406.13575 [hep-th] – In press

“Enhancing the Sensitivity to Seesaw Predictions in Gauged Scenario”

Capozzi, Dutta, Gurung, Jang, Shoemaker, Thompson, Yu,

arXiv2410:_____ to be submitted to PRD



Proceedings

“CMB and Lyman- α constraints on dark matter decays to photons”

F. Capozzi, R.Z. Ferreira, L.Lopez-Honorez, O. Mena

Contribution to: BSM-2023, doi:10.31526/ACP.BSM-2023.2

Towards understanding fermion masses and mixings

Zurab Berezhiani^{a,b}, Benedetta Belfatto^c

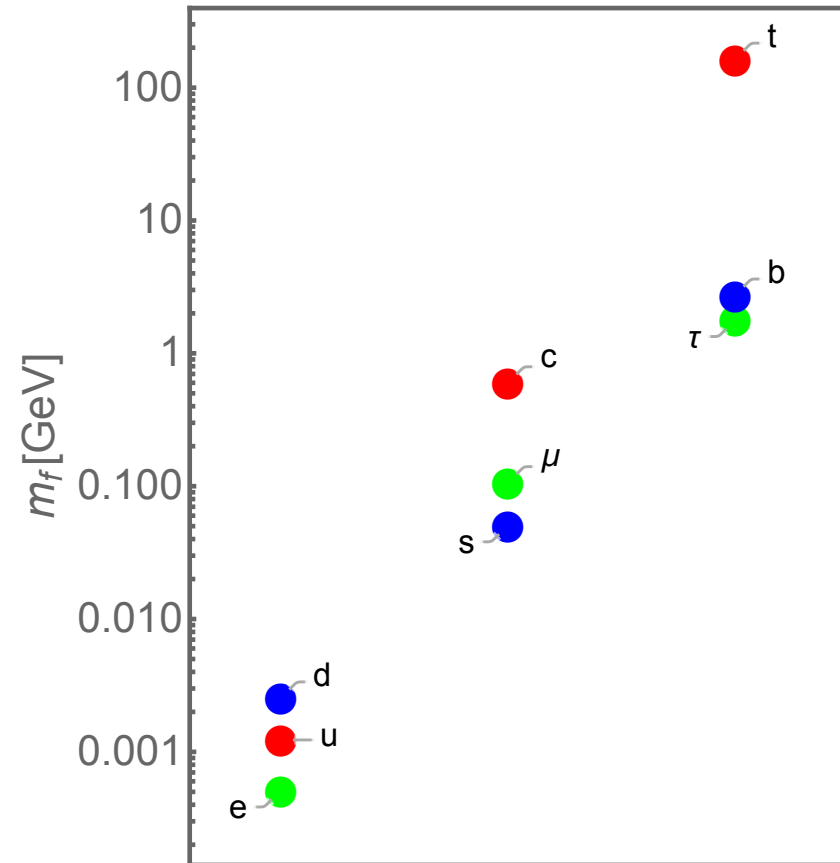
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^b *INFN, Laboratori nazionali del Gran sasso, Assergi, 67100 L'Aquila, Italy*

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Abstract

The Standard Model does not constrain the form of the Yukawa matrices and thus the origin of fermion mass hierarchies and mixing pattern remains puzzling. On the other hand, there are intriguing relations between the quark masses and their weak mixing angles, such as the well-known one $\tan \theta_C = \sqrt{m_d/m_s}$ for the Cabibbo angle, which may point towards specific textures of Yukawa matrices hypothesized by Harald Fritzsch at the end of the 70's. Though the original ansatz of Fritzsch is excluded by the experimental data, one can consider its minimal modification which consists in introducing an asymmetry between the 23 and 32 entries in the down-quark Yukawa matrix. We show that this structure is perfectly compatible with the present precision data on quark masses and CKM mixing matrix, and theoretically it can be obtained in the context of $SU(5)$ model with inter-family $SU(3)_H$ symmetry. We also discuss some alternative approaches which could give a natural description of the fermion mass spectrum and weak mixing pattern.



Solar fusion III: New data and theory for hydrogen-burning stars.

In stars that lie on the main sequence in the Hertzsprung Russel diagram, like our sun, hydrogen is fused to helium in a number of nuclear reaction chains and series, such as the proton-proton chain and the carbon-nitrogen-oxygen cycles. Precisely determined thermonuclear rates of these reactions lie at the foundation of the standard solar model.

This review, the third decadal evaluation of the nuclear physics of hydrogen-burning stars, is motivated by the great advances made in recent years by solar neutrino observatories, putting experimental knowledge of the proton-proton chain neutrino fluxes in the few-percent precision range. The basis of the review is a one-week community meeting held in July 2022 in Berkeley, California, and many subsequent digital meetings and exchanges.

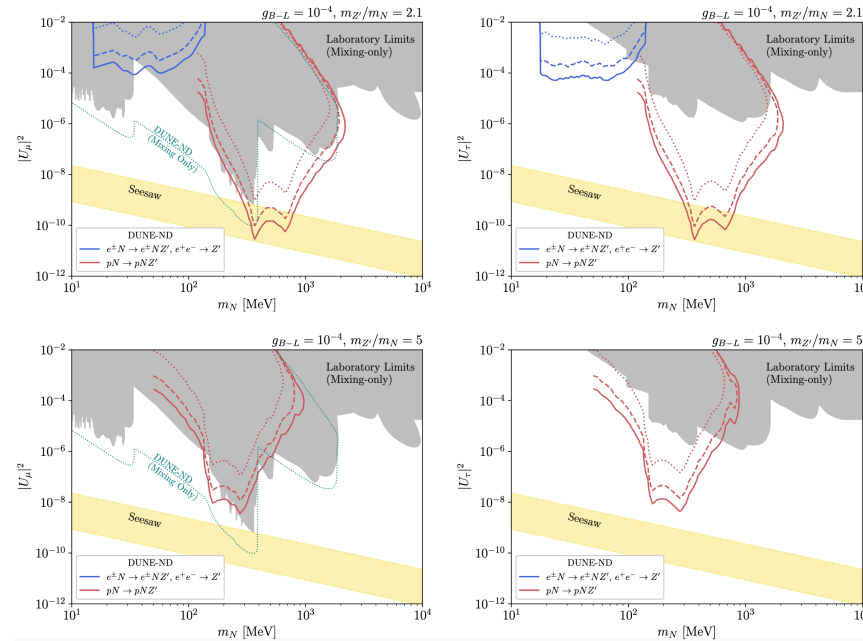
Each of the relevant reactions of solar and quiescent stellar hydrogen burning is reviewed here, from both theoretical and experimental perspectives. Recommendations for the state of the art of the astrophysical S-factor and its uncertainty are formulated for each of them.

Several other topics of paramount importance for the solar model are reviewed, as well: recent and future neutrino experiments, electron screening, radiative opacities, and current and upcoming experimental facilities. In addition to reaction-specific recommendations, also general recommendations are formed.

Enhancing the Sensitivity to Seesaw Predictions in Gauged $U(1)_{B-L}$ Scenario

$U(1)_{B-L}$: Z' and N (sterile- ν). Z' is produced in the proton target.
Signature: $Z' \rightarrow N$ in the target and $N \rightarrow \text{SM}$ in the detector ($m_{Z'} > m_N$)

Capozzi, Dutta, Gurung, Jang, Shoemaker, Thompson, Yu, to be submitted to PRD



DUNE extends constraints on N-SM mixing for $m_N \in [10^2, 10^3]$ MeV.
 Potential to reach Seesaw region.

Talks and seminars

- Neutrino Frontiers, Jun 25, 2024 - Jul 19, 2024, GGI, Firenze, Italy
“Solar models, solar neutrinos and helioseismology”, **F.L. Villante**
“Sterile Neutrino Candidates: The Good, The Bad, The Ugly”, **Z. Berezhiani**
- Int. Conf. on Particle Physics and Cosmology dedicated to Memory of Valery Rubakov, Yerevan, 2-7 Oct. 2023, Armenia
“Matter, Dark Matter and Antimatter in the Universe, and the Origin of Antinuclei in the Cosmic Rays”, **Z. Berezhiani**
- NOW 2024, 2–8 Sept 2024, Otranto, Italy
“The VHE nu (and gamma-ray) flux from the galactic plane”, **F.L. Villante**
“Extreme energy cosmic rays and DM”, **Z. Berezhiani**
- Sesto Incontro Nazionale di Fisica Nucleare (INFN2024) 26–28 Feb 2024, Trento, Italy
“Cosmological and stellar nuclear processes”, **F.L. Villante**
- BSM-2023, 6-9 November 2023, Hurghada, Egypt
“CMB and Lyman- α constraints on dark matter decays to photons”, **F. Capozzi**
- Veniamine Berezinsky Memorial Conference, GSSI, L'Aquila, Italy, 1-3 Oct. 2024
“Ultra High Energy Cosmic Rays and Dark Matter”, **Z. Berezhiani**

Planned research activity for 2025

- What can be learnt from the next core collapse supernovae (astro- and particle physics) combining all future detectors and using modern supernova models (Beacom, **Capozzi**, Li, Roberts, Smith);
- Update of global analysis of neutrino mass-mixing, using latest oscillation and non-oscillation data (cosmology, $0\nu\beta\beta$) (Capozzi, Di Valentino, Giare, Lisi, Marrone, Melchiorri)
- Studying galactic and extragalactic neutrino and gamma emissions at very high energy (**Villante**, Pagliaroli, Vecchiotti)
- Updating and Reviewing Standard solar models (**Villante**, Serenelli, Herrera, Invited review on Prog.Part.Nucl. Physics - 06/2025)

Financial situation

- At the moment, we have spent:

~4500 Euros (~3600 Internal missions + 900 Conference Fees)

- Timesheets (still not closed, it can be modified):

- F.L. Villante (200 h)

- Z. Berezhiani (100 h)

- F. Capozzi (100 h)

- Conferimenti di Incarico – Not requested (at the moment by our organization)

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< **OTTOBRE 2024** > APERTO

	Mar 1	Mer 2	Gio 3	Ven 4	Sab 5	Dom 6	Lun 7	Mar 8	Mer 9	Gio 10
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+ REGISTRI 2024/25										
- DIARIO 2024/25										
1. DIDATTICA INTEGRATIVA E POST-LAUREAM										
2. VERIFICA DELL'APPRENDIMENTO										
3. SERVIZIO AGLI STUDENTI										
4. ORGANIZZAZIONE DELLA DIDATTICA										
5. INCARICHI DIPARTIMENTALI										
6. ALTRI INCARICHI (ATENEO ...)										
- RIC_NAZ										
PE2VILLANTE										

ANNULLA MODIFICHE |
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