

DAFTAR PUSTAKA

Adhikari, R., Agostini, M., Ky, N. A., Araki, T., Archidiacono, M., Bahr, M., Baur, J., Behrens, J., Bezrukov, F., Dev, P. B., Borah, D., Boyarsky, A., de Gouvea, A., de S. Pires, C., de Vega, H., Dias, A., Bari, P. D., Djurcic, Z., Dolde, K., Dorrer, H., Durero, M., Dragoun, O., Drewes, M., Drexlin, G., Düllmann, C., Eberhardt, K., Eliseev, S., Enss, C., Evans, N., Faessler, A., Filianin, P., Fischer, V., Fleischmann, A., Formaggio, J., Franse, J., Fraenkle, F., Frenk, C., Fuller, G., Gastaldo, L., Garzilli, A., Giunti, C., Glück, F., Goodman, M., Gonzalez-Garcia, M., Gorbunov, D., Hamann, J., Hannen, V., Hannestad, S., Hansen, S., Hassel, C., Heeck, J., Hofmann, F., Houdy, T., Huber, A., Iakubovskiy, D., Ianni, A., Ibarra, A., Jacobsson, R., Jeltama, T., Jochum, J., Kempf, S., Kieck, T., Korzeczek, M., Kornoukhov, V., Lachenmaier, T., Laine, M., Langacker, P., Lasserre, T., Lesgourgues, J., Lhuillier, D., Li, Y., Liao, W., Long, A., Maltoni, M., Mangano, G., Mavromatos, N., Menci, N., Merle, A., Mertens, S., Mirizzi, A., Monreal, B., Nozik, A., Neronov, A., Niro, V., Novikov, Y., Oberauer, L., Otten, E., Palanque-Delabrouille, N., Pallavicini, M., Pantuev, V., Papastergis, E., Parke, S., Pascoli, S., Pastor, S., Patwardhan, A., Pilaftsis, A., Radford, D., Ranitzsch, P.-O., Rest, O., Robinson, D., da Silva, P. R., Ruchayskiy, O., Sanchez, N., Sasaki, M., Saviano, N., Schneider, A., Schneider, F., Schwetz, T., Schönert, S., Scholl, S., Shankar, F., Shrock, R., Steinbrink, N., Strigari, L., Suekane, F., Suerfu, B., Takahashi, R., Van, N. T. H., Tkachev, I., Totzauer, M., Tsai, Y., Tully, C., Valerius, K., Valle, J., Venos, D., Viel, M., Vivier, M., Wang, M., Weinheimer, C., Wendt, K., Winslow, L., Wolf, J., Wurm, M., Xing, Z., Zhou, S., dan Zuber, K., 2017, A white paper on keV sterile neutrino dark matter, *Journal of Cosmology and Astroparticle Physics*, 01, 2017, 025–025.

Aguilar-Arevalo, A. A., Brown, B. C., Conrad, J. M., Dharmapalan, R., Diaz, A., Djurcic, Z., Finley, D. A., Ford, R., Garvey, G. T., Gollapinni, S., Hourlier, A., Huang, E. C., Kamp, N. W., Karagiorgi, G., Katori, T., Kobilarcik, T., Lin, K., Louis, W. C., Mariani, C., Marsh, W., Mills, G. B., Mirabal-Martinez, J., Moore, C. D., Nelson, R. H., Nowak, J., Pavlovic, Z., Ray, H., Roe, B. P., Russell, A. D., Schneider, A.,

- Shaevitz, M. H., Spitz, J., Stancu, I., Tayloe, R., Thornton, R. T., Tzanov, M., Van de Water, R. G., White, D. H., dan Zimmerman, E. D., 2022, 'Miniboone and microboone joint fit to a 3+1 sterile neutrino scenario'.
- Alpher, R. A., Bethe, H., dan Gamow, G., 1948, The origin of chemical elements, *Phys. Rev.*, 7, 73, 803–804.
- Archidiacono, M., Hannestad, S., Hansen, R. S., dan Tram, T., 2015, Cosmology with self-interacting sterile neutrinos and dark matter: A pseudoscalar model, *Phys. Rev. D*, 6, 91, 065021.
- Argüelles, C. A., Esteban, I., Hostert, M., Kelly, K. J., Kopp, J., Machado, P. A. N., Martinez-Soler, I., dan Perez-Gonzalez, Y. F., 2022, Microboone and the ν_e interpretation of the miniboone low-energy excess, *Phys. Rev. Lett.*, 24, 128, 241802.
- Aver, E., Olive, K. A., dan Skillman, E. D., 2015, The effects of the $\lambda 10830$ on helium abundance determinations, *Journal of Cosmology and Astroparticle Physics*, 07, 2015, 011–011.
- Bahcall, J. N., 1964, Solar neutrinos. i. theoretical, *Phys. Rev. Lett.*, 11, 12, 300–302.
- Bell, N. F., Volkas, R. R., dan Wong, Y. Y. Y., 1999, Relic neutrino asymmetry evolution from first principles, *Phys. Rev. D*, 11, 59, 113001.
- Berezhiani, Z., Dolgov, A., dan Mohapatra, R., 1996, Asymmetric inflationary reheating and the nature of mirror universe, *Physics Letters B*, 1, 375, 26–36.
- Berezhiani, Z. G., dan Mohapatra, R. N., 1995, Reconciling present neutrino puzzles: Sterile neutrinos as mirror neutrinos, *Phys. Rev. D*, 11, 52, 6607–6611.
- Boyarsky, A., Drewes, M., Lasserre, T., Mertens, S., dan Ruchayskiy, O., 2019, Sterile neutrino dark matter, *Progress in Particle and Nuclear Physics*, , 104, 1–45.
- Boyarsky, A., Iakubovskyi, D., Ruchayskiy, O., dan Savchenko, D., 2018, 'Surface brightness profile of the 3.5 keV line in the Milky Way halo'.
- Boyarsky, A., Ruchayskiy, O., Iakubovskyi, D., dan Franse, J., 2014, Unidentified line in x-ray spectra of the Andromeda galaxy and Perseus galaxy cluster, *Phys. Rev. Lett.*, 25, 113, 251301.

- Bulbul, E., Markevitch, M., Foster, A., Smith, R. K., Loewenstein, M., dan Randall, S. W., 2014, DETECTION OF AN UNIDENTIFIED EMISSION LINE IN THE STACKED x-RAY SPECTRUM OF GALAXY CLUSTERS, *The Astrophysical Journal*, 1, 789, 13.
- Christenson, J. H., Cronin, J. W., Fitch, V. L., dan Turlay, R., 1964, Evidence for the 2π decay of the k_2^0 meson, *Phys. Rev. Lett.*, 4, 13, 138–140.
- Chu, X., Dasgupta, B., Dentler, M., Kopp, J., dan Saviano, N., 2018, Sterile neutrinos with secret interactions—cosmological discord?, *Journal of Cosmology and Astroparticle Physics*, 11, 2018, 049–049.
- Chu, X., Dasgupta, B., dan Kopp, J., 2015, Sterile neutrinos with secret interactions—lasting friendship with cosmology, *Journal of Cosmology and Astroparticle Physics*, 10, 2015, 011–011.
- Cleveland, B. T., Daily, T., Raymond Davis, J., Distel, J. R., Lande, K., Lee, C. K., Wildenhain, P. S., dan Ullman, J., 1998, Measurement of the solar electron neutrino flux with the homestake chlorine detector, *The Astrophysical Journal*, 1, 496, 505–526.
- Cline, J. M., dan Roux, J.-S., 2022, Asymmetric reheating from a symmetric inflationary potential, *Phys. Rev. D*, , 105, 043506.
- Colangelo, G., dan Dürr, S., 2004, The pion mass in finite volume, *The European Physical Journal C - Particles and Fields*, 4, 33, 543–553.
- Cooke, R. J., dan Fumagalli, M., 2018, Measurement of the primordial helium abundance from the intergalactic medium, *Nature Astronomy*, 12, 2, 957–961.
- Cowan, C. L., Reines, F., Harrison, F. B., Kruse, H. W., dan McGuire, A. D., 1956, Detection of the free neutrino: a confirmation, *Science*, 3212, 124, 103–104.
- Danby, G., Gaillard, J.-M., Goulianos, K., Lederman, L. M., Mistry, N., Schwartz, M., dan Steinberger, J., 1962, Observation of high-energy neutrino reactions and the existence of two kinds of neutrinos, *Phys. Rev. Lett.*, 1, 9, 36–44.

- Dasgupta, B., dan Kopp, J., 2014, Cosmologically safe ν -scale sterile neutrinos and improved dark matter structure, *Phys. Rev. Lett.*, 3, 112, 031803.
- Davis, R., 1964, Solar neutrinos. ii. experimental, *Phys. Rev. Lett.*, 11, 12, 303–305.
- Davis, R., Harmer, D. S., dan Hoffman, K. C., 1968, Search for neutrinos from the sun, *Phys. Rev. Lett.*, 21, 20, 1205–1209.
- de Salas, P. F., dan Pastor, S., 2016, Relic neutrino decoupling with flavour oscillations revisited, *Journal of Cosmology and Astroparticle Physics*, 07, 2016, 051–051.
- Diaz, A., Argüelles, C., Collin, G., Conrad, J., dan Shaevitz, M., 2020, Where are we with light sterile neutrinos?, *Physics Reports*, , 884, 1–59.
- Dolgov, A., 2002, Neutrinos in cosmology, *Physics Reports*, 4, 370, 333–535.
- Esteban, I., Gonzalez-Garcia, M. C., Maltoni, M., Schwetz, T., dan Zhou, A., 2020, The fate of hints: updated global analysis of three-flavor neutrino oscillations, *Journal of High Energy Physics*, 9, 2020, 178.
- Fernández, V., Terlevich, E., Díaz, A. I., dan Terlevich, R., 2019, A Bayesian direct method implementation to fit emission line spectra: Application to the primordial He abundance determination, *Mon. Not. Roy. Astron. Soc.*, 3, 487, 3221–3238.
- FLAG Working Group, 2014, Review of lattice results concerning low-energy particle physics, *The European Physical Journal C*, 9, 74, 2890.
- Foot, R., 1994, Neutrino Oscillations and the Exact Parity Model, *Modern Physics Letters A*, 2, 9, 169–179.
- Foot, R., dan Lew, H., 1994, ‘A novel left-right symmetric model’.
- Foot, R., Lew, H., dan Volkas, R. R., 2000, Unbroken versus broken mirror world: a tale of two vacua, *Journal of High Energy Physics*, 07, 2000, 032–032.
- Foot, R., Thomson, M. J., dan Volkas, R. R., 1996, Large neutrino asymmetries from neutrino oscillations, *Phys. Rev. D*, , 53, R5349–R5353.

- Foot, R., dan Volkas, R. R., 1995*a*, Neutrino physics and the mirror world: How exact parity symmetry explains the solar neutrino deficit, the atmospheric neutrino anomaly, and the lsnd experiment, *Phys. Rev. D*, 11, 52, 6595–6606.
- Foot, R., dan Volkas, R. R., 1995*b*, Reconciling sterile neutrinos with big bang nucleosynthesis, *Phys. Rev. Lett.*, 24, 75, 4350–4353.
- Forastieri, F., Lattanzi, M., Mangano, G., Mirizzi, A., Natoli, P., dan Saviano, N., 2017, Cosmic microwave background constraints on secret interactions among sterile neutrinos, *Journal of Cosmology and Astroparticle Physics*, 07, 2017, 038–038.
- Friedman, J. I., dan Telegdi, V. L., 1957, Nuclear emulsion evidence for parity nonconservation in the decay chain $\pi^+ \rightarrow \mu^+ \rightarrow e^+$, *Phys. Rev.*, 5, 105, 1681–1682.
- Garwin, R. L., Lederman, L. M., dan Weinrich, M., 1957, Observations of the failure of conservation of parity and charge conjugation in meson decays: the magnetic moment of the free muon, *Phys. Rev.*, 4, 105, 1415–1417.
- Giunti, C., dan Kim, C. W., 2007, *Fundamentals of Neutrino Physics and Astrophysics*, Oxford University Press, Oxford.
- Giunti, C., dan Laveder, M., 2011, 3+1 and 3+2 Sterile Neutrino Fits, *Phys. Rev. D*, , 84, 073008.
- Hannestad, S., Hansen, R. S., dan Tram, T., 2014, How self-interactions can reconcile sterile neutrinos with cosmology, *Phys. Rev. Lett.*, 3, 112, 031802.
- Hannestad, S., Tamborra, I., dan Tram, T., 2012, Thermalisation of light sterile neutrinos in the early universe, *Journal of Cosmology and Astroparticle Physics*, 07, 2012, 025–025.
- Hollik, W. G., dan Saldaña Salazar, U. J., 2015, The double mass hierarchy pattern: Simultaneously understanding quark and lepton mixing, *Nuclear Physics B*, , 892, 364–389.
- Hsyu, T., Cooke, R. J., Prochaska, J. X., dan Bolte, M., 2020, The PHLEK Survey: A New Determination of the Primordial Helium Abundance, *Astrophys. J.*, 1, 896, 77.

Jarlskog, C., 1985, Commutator of the quark mass matrices in the standard electroweak model and a measure of maximal CP nonconservation, *Phys. Rev. Lett.*, , 55, 1039–1042.

Kaplan, D. B., 2016, Lectures on effective field theory, , .

Kawasaki, M., dan Murai, K., 2022, ‘Lepton asymmetric universe’.

Kibble, T. W. B., 2015, History of electroweak symmetry breaking, *Journal of Physics Conference Series*, 1, 626, 10.

Kobzarev, I. Y., Okun, L. B., dan Pomeranchuk, I. Y., 1966, On the possibility of experimental observation of mirror particles, *Sov. J. Nucl. Phys.*, 6, 3, 837–841.

Kopp, J., Machado, P. A. N., Maltoni, M., dan Schwetz, T., 2013, Sterile Neutrino Oscillations: The Global Picture, *JHEP*, , 05, 050.

Kurichin, O. A., Kislitsyn, P. A., Klimenko, V. V., Balashev, S. A., dan Ivanchik, A. V., 2021, A new determination of the primordial helium abundance using the analyses of H ii region spectra from SDSS, *Monthly Notices of the Royal Astronomical Society*, 2, 502, 3045–3056.

Lee, T. D., dan Yang, C. N., 1956, Question of parity conservation in weak interactions, *Phys. Rev.*, 1, 104, 254–258.

LSND Collaboration, 2001, Evidence for neutrino oscillations from the observation of $\bar{\nu}_e$ appearance in a $\bar{\nu}_\mu$ beam, *Phys. Rev. D*, , 64, 112007.

Maki, Z., Nakagawa, M., dan Sakata, S., 1962, Remarks on the Unified Model of Elementary Particles, *Progress of Theoretical Physics*, 5, 28, 870–880.

Matsumoto, A., Ouchi, M., Nakajima, K., Kawasaki, M., Murai, K., Motohara, K., Harikane, Y., Ono, Y., Kushibiki, K., Koyama, S., Aoyama, S., Konishi, M., Takahashi, H., Isobe, Y., Umeda, H., Sugahara, Y., Onodera, M., Nagamine, K., Kusakabe, H., Hirai, Y., Moriya, T. J., Shibuya, T., Komiyama, Y., Fukushima, K., Fujimoto, S., Hattori, T., Hayashi, K., Inoue, A. K., Kikuchihiro, S., Kojima, T., Koyama, Y., Lee, C.-H., Mawatari, K., Miyata, T., Nagao, T., Ozaki, S., Rauch, M., Saito, T., Suzuki, A., Takeuchi, T. T., Umemura, M., Xu, Y., Yabe, K., Zhang, Y., dan Yoshii, Y.,

- 2022, 'Empress. viii. a new determination of primordial he abundance with extremely metal-poor galaxies: A suggestion of the lepton asymmetry and implications for the hubble tension'.
- MicroBooNE Collaboration, 2022a, Search for an excess of electron neutrino interactions in microboone using multiple final-state topologies, *Phys. Rev. Lett.*, 24, 128, 241801.
- MicroBooNE Collaboration, 2022b, Search for neutrino-induced neutral-current Δ radiative decay in microboone and a first test of the miniboone low energy excess under a single-photon hypothesis, *Phys. Rev. Lett.*, 11, 128, 111801.
- Mikheyev, S. P., dan Smirnov, A. Y., 1986, Resonant amplification of ν oscillations in matter and solar-neutrino spectroscopy, *Il Nuovo Cimento C*, 1, 9, 17–26.
- MiniBooNE Collaboration, 2021, Updated miniboone neutrino oscillation results with increased data and new background studies, *Phys. Rev. D*, 5, 103, 052002.
- Moulai, M. H., Argüelles, C. A., Collin, G. H., Conrad, J. M., Diaz, A., dan Shaevitz, M. H., 2020, Combining sterile neutrino fits to short-baseline data with icecube data, *Phys. Rev. D*, 5, 101, 055020.
- Okun', L. B., 2007, Mirror particles and mirror matter: 50 years of speculation and searching, *Physics-Uspekhi*, 4, 50, 380–389.
- Particle Data Group, 2018, Review of particle physics, *Phys. Rev. D*, , 98, 030001.
- Particle Data Group, 2020, Review of Particle Physics, *Progress of Theoretical and Experimental Physics*, 8, 2020, . 083C01.
- Peimbert, A., Peimbert, M., dan Luridiana, V., 2016, The primordial helium abundance and the number of neutrino families, *Rev. Mex. Astron. Astrofís.*, , 52, 419.
- Planck Collaboration, 2014, Planck 2013 results. xvi. cosmological parameters, *A&A*, , 571, A16.
- Planck Collaboration, 2020, Planck 2018 results - vi. cosmological parameters, *A&A*, , 641, A6.

- Pontecorvo, B., 1957, Inverse beta processes and nonconservation of lepton charge, *Zh. Eksp. Teor. Fiz.*, , 34, 247.
- Pontecorvo, B., 1967, Neutrino Experiments and the Problem of Conservation of Leptonic Charge, *Zh. Eksp. Teor. Fiz.*, , 53, 1717–1725.
- Quigg, C., dan Shrock, R., 2009, Gedanken worlds without higgs fields: Qcd-induced electroweak symmetry breaking, *Phys. Rev. D*, 9, 79, 096002.
- Satriawan, M., 2018, ‘A multicomponent dark matter in a model with mirror symmetry with additional charged scalars’.
- Saviano, N., Mirizzi, A., Pisanti, O., Serpico, P. D., Mangano, G., dan Miele, G., 2013, Multimomentum and multiflavor active-sterile neutrino oscillations in the early universe: Role of neutrino asymmetries and effects on nucleosynthesis, *Phys. Rev. D*, 7, 87, 073006.
- Shaposhnikov, M., 2008, The ν MSM, leptonic asymmetries, and properties of singlet fermions, *Journal of High Energy Physics*, 08, 2008, 008–008.
- Sicilian, D., Cappelluti, N., Bulbul, E., Civano, F., Moschetti, M., dan Reynolds, C. S., 2020, Probing the milky way’s dark matter halo for the 3.5 keV line, *The Astrophysical Journal*, 2, 905, 146.
- Silich, E. M., Jahoda, K., Angelini, L., Kaaret, P., Zajczyk, A., LaRocca, D. M., Ringuelette, R., dan Richardson, J., 2021, A search for the 3.5 keV line from the milky way’s dark matter halo with HaloSat, *The Astrophysical Journal*, 1, 916, 2.
- Smirnov, A. Y., 2019, The mikheyev-smirnov-wolfenstein (msw) effect, *arXiv: High Energy Physics - Phenomenology*, .
- Super-Kamiokande Collaboration, 1998, Evidence for oscillation of atmospheric neutrinos, *Phys. Rev. Lett.*, 8, 81, 1562–1567.
- Susskind, L., 1979, ‘Dynamics of spontaneous symmetry breaking in the weinberg-salam theory’.

- Takahashi, F., dan Yamaguchi, M., 2004, Spontaneous baryogenesis in flat directions, *Phys. Rev. D*, , 69, 083506.
- Valerdi, M., dan Peimbert, A., 2019, ‘A new determination of the primordial helium abundance based on the hii region ngc 346’.
- Wolfenstein, L., 1978, Neutrino oscillations in matter, *Phys. Rev. D*, 9, 17, 2369–2374.
- Wu, C. S., Ambler, E., Hayward, R. W., Hoppes, D. D., dan Hudson, R. P., 1957, Experimental test of parity conservation in beta decay, *Phys. Rev.*, 4, 105, 1413–1415.
- Xing, Z.-Z., dan Zhou, S., 2011, *Neutrinos in Particle Physics, Astronomy and Cosmology*, Advanced Topics in Science and Technology in China, jointly published with zhejiang university press edn, Springer.