IceCube Detection of a High-Energy Particle – Antineutrino of "Unmistakably of Extraterrestrial Origin" – A Spiritual Insight

By MATSATI - March 27, 2021



In the recent scientific research [1], researchers report data from a neutrino detector in the South Pole. You might be wondering, "what is a neutrino?" A neutrino is a neutral subatomic particle with a mass close to zero and half-integral spin, and rarely reacts with normal matter. Three kinds of neutrinos are known, associated with the electron, muon, and tau particles. The majority of neutrinos which are detected upon the Earth are from nuclear reactions inside the Sun. At the surface of the Earth, the flux is about 65 billion solar neutrinos, per second per square centimeter. Neutrinos can be used for tomography of the interior of the earth. (Tomography is a technique for displaying a representation of a cross section through an object using x-rays or ultrasound, and in this case for the earth, neutrinos.) In the 1960s, the now-famous "Homestake experiment" made the first measurement of the flux of electron neutrinos arriving from the core of the Sun and found a value that was between one third and one half the number predicted by the Standard Solar Model. This discrepancy became known as the solar neutrino problem, and remained unresolved for some thirty years, while possible problems with both the experiment and the solar model were investigated, but none could be found. Eventually it was realized that both were actually correct, and that the discrepancy between them was due to neutrinos being more complex than was previously assumed. It was postulated that there were three neutrinos that had nonzero and slightly different masses, and could therefore oscillate into undetectable flavors on their flight to the Earth. This hypothesis was investigated by a new series of experiments, thereby opening a new major field of research that still continues today. For each neutrino, there also exists a corresponding antiparticle, called an antineutrino, which also has no electric charge and half-integer spin. They are distinguished from the neutrinos by having opposite signs of lepton number (a conserved quantum number representing the difference between the number of leptons and the number of antileptons in an elementary particle reaction) and opposite chirality (a property of

asymmetry important in several branches of science). Antineutrinos were first detected as a result of their interaction with protons in a large tank of water. This was installed next to a nuclear reactor as a controllable source of the antineutrinos (the "Cowan-Reines neutrino experiment"). As a result of this, Researchers around the world have begun to investigate the possibility of using antineutrinos for reactor monitoring in the context of preventing the proliferation of nuclear weapons. These things answer the question of why do we want to study neutrinos and antineutrinos.

References

- 1. The IceCube Collaboration., Aartsen, M.G., Abbasi, R. et al. Detection of a particle shower at the Glashow resonance with IceCube. Nature 591, 220–224 (2021). https://doi.org/10.1038/s41586-021-03256-1
- 1. The IceCube Collaboration., Aartsen, M.G., Abbasi, R. et al. **Detection of a particle** shower at the Glashow resonance with IceCube. Nature 591, 220–224 (2021). https://doi.org/10.1038/s41586-021-03256-1

In their experimental work, the researchers observed a Glashow resonance event, where the Nobel laureate physicist Sheldon Glashow in 1960 postulated how an electronantineutrino and an electron interact to produce a W-boson. The researchers reported data that was collected back at the end of 2016 when an antineutrino arrived at Earth at near the speed of light having an energy of 6.3 peta-electronvolts (PeV, 10^15 V). In an ice sheet located at the South Pole the antineutrino interacted with an electron that led to the particle decaying into a series of secondary particles. The antineutrino interaction was observed using a massive detector buried in the Antarctic glacier called "the IceCube Neutrino Observatory." The Glashow resonance is the formation of the W-boson in antineutrino-electron collisions ($V_e + e^- \rightarrow W^-$). The idea of this being extraterrestrial in origin is that the antineutrino did not originate from the Sun (i.e. a supernova). When the W- boson was finally discovered in 1983, the experimental results suggested that the boson was much heavier than what Glashow had predicted back in 1960. This Glashow resonance therefore would require a neutrino with an energy of 6.3 PeV, which is around 1,000 times more energetic than what the CERN Large Hadron Collider is capable of producing. Note this is why larger and larger colliders are always being built to study this phenomenon, and not for opening interdimensional demonic portals as the conspiracy theorists are always saying!

The actual observation of this very high energy particle is noteworthy because of its very high energy, and because this is only the third antineutrino detected with energy greater than 5 PeV since the building of the facility and full operation in 2011. The researchers state, "This result proves the feasibility of neutrino astronomy – and IceCube's ability to do it – which will play an important role in future multimessenger astroparticle physics." These results open a new field of neutrino astronomy as the facility is capable of disentangling neutrinos from their antineutrinos. The sensors at this facility are sensitive enough to make measurements of the differences between neutrinos and antineutrinos. The researchers next goal is to try and measure this difference and the calculating the neutrino/antineutrino ratio which would allow the determination of the magnetic field strength of the source that originally accelerated the particle. The IceCube detector project in the South Pole was originally funded so that researchers could detect these very high energy neutrinos. In only

a few years of operation, the detector detected these particles doing exactly what it was originally meant to do successfully!

The Spiritual Insights that we obtain from this type of research is related to the Glashow resonance and the formation of the W-boson in the antineutrino-electron collisions (Ve + $e^- \rightarrow W^-$). When we lay this type of research down alongside the Scriptures, the particular aspect that is drawn out is "What king of interaction and transformation does God produce in our lives when we encounter Him?" In the sense of the physics experiment, the physical properties of the neutrino cause it to interact with matter only on a small scale, meaning very infrequently. When the interaction occurs, there is a large release of energy which is a measurable phenomenon. In the case of the Glashow resonance reaction the antineutrino collides with an electron and produces something new (a W-boson). The antineutrino interaction produces something different, a heavy fundamental particle. These things draw out the concept of our relationship with God and how God works in our lives. The place to begin studying these things is by looking at the Torah and specifically at the book of Devarim / Deuteronomy and seeing what Moshe has to say to God's people about what God expects of them!

ספר דברים פרק י

יב וְעַתָּהֹ יִשְׂרָאֵׁל מָה יָהוָה אֱלֹהֶׁיךּ שֹׁאֵל מֵעמֶּךְ כֵּי אִם־לְּיִרְאָה אֶת־יִהוָּה אֱלֹהֶׁיךּ לָלֶכֶת בְּכָל־דְּרָכִיוֹ וּלְאַהְבָּה אֹתוֹ וְלָעֲבֹד אֶת־יִהוָה אֱלֹהֶׁיךּ בְּכָל־לְבָבָךָ וּבְכָל־נַפְשֶׁךְ יג לשְמֵׁר אֶת־מִצְוֹת יְהוָה וְאֶת־חֻלְּתִּיוֹ אֲשֶׁר אָנֹכִי מְצַוּךָ הֵיִּיוֹם לְטָוֹב לֶךְ:

DEVARIM / DEUTERONOMY 10:12-13

12 "AND NOW, ISRAEL, WHAT DOES THE LORD YOUR GOD
REQUIRE OF YOU, BUT TO FEAR THE LORD YOUR GOD, TO WALK IN
ALL HIS WAYS AND LOVE HIM, AND TO SERVE THE LORD YOUR
GOD WITH ALL YOUR HEART AND WITH ALL YOUR SOUL, 13 AND
TO KEEP THE LORD'S COMMANDMENTS AND HIS STATUTES
WHICH I AM COMMANDING YOU TODAY FOR YOUR GOOD?
(NASB)

These scriptures remind us of the Shema in Devarim / Deuteronomy 6. And in summary, the statement Moshe is making is asking the question וְעַתָּה שֵׁלֹהְיף שׁאֵל מֵה יְהוָה אֱלֹהֶיף שׁאֵל מֵה יְהוָה אֱלֹהֶיף שׁאֵל מֵה יְהוָה אֱלֹהֶיף שׁאֵל מֵה יִהוָה אֱלֹהֶיף שׁאֵל מֵה יִהוָה אֱלֹהֶיף Yes, this text suggests that God expects something from us who are His people. The first thing the Lord expects is as the text states is, אְלֹהֶיף שֻׁלֹהְי (yirat Hashem, the fear of the Lord). This does not mean that we are to be afraid of the Lord, but is connected in the text to what we are reading here in relation to the fear of the Lord as directing our lives to walking in God's ways of righteousness, holiness, and truth, which relates to how receptive our hearts and souls are to the Lord, the call of the Spirit, and the Word. The yirat HaShem (fear of the Lord) causes us to be able to recognize sin, and affects how receptive we are to God's Word, to our Savior Yeshua, and also speaks to the significance of how God sanctifies us and how we are to live in that condition sanctifying (setting apart) our lives here on Earth for God's glory. The Scriptures explain to us how to properly apart) (fear) the Lord. It is only when we properly fear the Lord that we are able וֹלַצְתַר בְּכַל־דְרָכִי (fear) the Lord. It is only when we properly fear the Lord that we are able "ictor walk in all His ways," in all to love Him," "and to love Him, "and to love Him," "and to love Him, "and to love Him," to love Him, "and to love Him," to love Him, "and to love Him, "and to love

" אַת־יָהוַה and to serve the Lord," and to do so אָת־יָהוָה בֶּכַל־לְבָבַךּ וּבְכַל־לַבָבַרָּ וּבְכַל־לַבָבַרָּ your soul." What the Lord asks of us is that we have the fear of the Lord first. This is then related to how the Lord works in our lives to transform us. Like the Glashow resonance reaction and the transformation of an electron into a W-Boson by the collision event, the Word of God has the power to collide with our lives if we allow it. In addtion, we must humble ourselves so the word of God transforms us as we believe God has spoken in the pages of the scriptures. Every time that we pick up a bible, open the pages, and read the Word, the Lord God in heaven is speaking to us! This is why we call the Bible the Word of God! Do you believe that? Some may ask, are we supposed to believe that God spoke only in times of old and not for today? Some theologies like Dispensationalism suggest that is the reality of our relationship with God and His power (or empowering) in our lives today! When we read the pages of the scriptures however, we realize the power of God to transcend time and space, and we are able to say God absolutely speaks to us today via His Word and He is able to do all things, even the miracles we read about in ancient times, today! All of these truths are drawn out from these two verses according to Devarim / Deuteronomy 10:12-13.

This transformational power is described according to Tehillim / Psalms 19, as David is praying and meditating upon the transformational power of God. Tehillim / Psalms 19:8, פּקּוּדִי מָצוַת יָהוָה בַּרָה מאִירָת עַינַיִם $oldsymbol{0}$ "the command of the Lord is pure, enlightening the eyes." David said the word of God enlightens our eyes to the reality of who we are, to what is within us, our sin, and to the power of God to transform. Just previous to this, the Psalms writes, "תוֹרָת יָהוָה תָּמִימָה מָשִׁיבַת נַפָּשׁ עָדוּת יִהוָה נַאָמָנָה מָחַכִּימָת פַּתִי "The Torah of the Lord is perfect, reviving the soul; the testimony of the Lord is sure, making wise the simple." What the Lord is saying through David is how the Word of God, His commands, are reviving causing life to come from death. This is consistent with what Paul wrote to the Ephesians saying "As for you, you were dead in your transgressions and sins." (Ephesians 2:1) The word of God causes us to become aware of who we are as being sanctified and the Lord transforming us to the image of Yeshua (Romans 8:29), strengthening us against temptation, corruption, and untruths (Ephesians 3:16), and building us up and establishing our hearts in holiness and faith. These are all reasons why we all need to read the Word daily, and when we do the Spirit of God speaks to us through His Holy Word. The fear, respect, and reverence of God leads to what Mishley / Proverbs 9:10 states, חָחֶלָת חֶכְתַח מָקָת יַרְאָת יָרַוּוֶה וְדָעַת קְדֹשְׁים כִּינֵה: "the beginning of wisdom is yirat HaShem (fear of the Lord) and knowledge of the holy one is understanding." This knowledge and understanding is a spiritual gift as helping us to not walk in darkness, and helping us to turn away from evil. (Tehillim / Psalms 111:10, Mishley / Proverbs 1:7, 9:10, 10:27, 14:27, 15:33, 16:6) Tehillim / Psalms 19:23 states, יַרָאָת יָהוֶה לְחַיֵּים וְשְׂבֵע יֻׁלֹוְ בַּל־יִפְקֶד רֶע: *"Fearing HaShem leads to* life, the one who does so rests satisfied and will not be visited with harm." Or HaChaim draws out an interesting aspect of Devarim / Deuteronomy 10:12-13 saying the following,

OR HACHAIM ON DEUTERONOMY 10:12 PART 1

ועתה ישראל...כי אם ליראה, AND NOW, ISRAEL, ...EXCEPT TO REVERE THE LORD, ETC." THE THRUST OF THIS VERSE HAS TO BE UNDERSTOOD ALONG THE FOLLOWING LINES. WE KNOW THAT THERE ARE TWO DIFFERENT LEVELS OF SERVING G'D, 1) TO SERVE HIM OUT OF FEAR, 2) TO SERVE HIM OUT OF LOVE... MOREOVER, FEAR, I.E. REVERENCE FOR G'D IS A FORERUNNER OF LOVE FOR G'D. MOSES HINTS AT THIS WHEN HE PREFACES THE VERSE WITH THE WORD ועתה, "AND NOW." HE MEANS THAT WHEREAS FOR NOW, INITIALLY, ALL THAT G'D ASKS FOR IS FOR YOU TO FEAR HIM, THERE WILL COME A TIME WHEN YOU WILL DO MORE THAN THAT, I.E. TO LOVE HIM. ONCE WE APPROACH THIS VERSE FROM THIS ANGLE WE CAN ALSO UNDERSTAND THE RHETORICAL "WHAT IS IT THAT G'D ASKS...ONLY THAT YOU FEAR HIM?" TO THE QUESTION THAT FEARING THE LORD IS SURELY NOT SUCH AN EASY THING, MOSES IMPLIES THAT ONCE YOU WILL HAVE ADVANCED TO SERVING THE LORD OUT OF LOVE YOU WILL REALISE THAT SERVING HIM OUT OF FEAR WAS REALLY SOMETHING MINOR BY COMPARISON. IN ABSOLUTE TERMS. SERVING THE LORD OUT OF FEAR IS SOMETHING VERY GREAT INDEED; IN RELATIVE TERMS, I.E. AFTER GRADUATING TO SERVING HIM OUT OF LOVE, IT IS ONLY A MINOR ACCOMPLISHMENT. THIS IS THE BEST WAY TO UNDERSTAND WHAT WE HAVE BEEN TAUGHT IN THIS CONNECTION IN MEGILLAH 25: "IS THEN SERVING G'D OUT OF FEAR SOMETHING SO MINOR?

The rabbinic conclusion based on this commentary is that serving God out of love is much weightier (more significant) than doing so out of fear. Notice how the rabbis are discussing what it means to fear God relative to the phrase אֲלֹהֵיף שֹאֱל מֶעְמֶּך "and now Israel, what is it the Lord your God asks of you, etc." one may be mistaken to think God is commanding to fear him only. However, the context states בֶּי אָם־לְיַרָאָה אֶת־יְהוָה אֱלֹבִיׁן בּ comprises all aspects of our לֶלֶכֶת בָּכָל־דְּרָכִיוֹ וּלְאַהַבֶּה אֹתוֹ וְלַעֲבֹדֹ אַת־יִהוֵה אֲלֹהֵיף בָּכָל־לְכָבָךְ וּבָכָל־נִפְשֵׁף lives, remember the heart (בְּכַל־נָפָשָׁךְ) connects to the spirit, and the nefesh (בְּכַל־נָפָשַׁרְ) to the carnal life (the flesh) life, so it is difficult to understand Moses as portraying God's demands upon us as something trivial. This is a very significant exhortation that encompasses all of who we are. According to verse 13 the text states, לשׁמَّר את־מצוֹת יהוה ן אָת־חַכּּלְיִיו אֲשֵׁר אָנֹכִי מְצַוְּךָּ הַיָּוֹם לְטָוֹב לֶךְ <u>"to listen to the commands of God and Hi</u>s statutes that I command you today, for your good," the Last part of the verse states לְטִוֹב לֶךְ for your good" showing when we seek to walk in God's ways (לַלֶכֶת בָּכֶל־דָּרֶכִיוֹ) clearly there is a benefit for us, and especially when doing so out of love. The reason this verse from the Torah is so significant is in relation to this fear and love of God as opening the way to Teshuva / תשובה, (Repentance). Note also how according to Midrash Rabbah on Bereshit / Genesis 21 part 6, the word עתה is interpreted as always being an opening for man to repent from his sin. Note how the verse under discussion in that Midrash is Bereshit / Genesis 3:22 when God expels Adam and Eve from the garden of Eden. According to this approach the words וְעַתַּה יִשְׁרָאֵל מָה יִהוָה אֱלֹהֵוֹף שׁאֲל מֶעְמַך mean that the Lord God makes it very easy for us to become repentant because God is merciful and full of grace. This all begins when we start with yirat Hashemi (the fear/reverence of the Lord). It is these combination of these things, to have faith, to fear the Lord, to be repentant, and seeking

God's Messiah Yeshua that transformation comes. Note how this transformation is all the work of the Lord and His Messiah according to Isaiah 11:1-2.

ספר ישעיה פרק יא

א וְיָצָא חֹטֶר מִגֶּזַע יִשָּׁי וְנֵצֶר מִשָּׁרָשָׁיו יִפְּרֶה: ב וְנָחָה עָלָיו רוּחַ יְהֹוָה רוּחַ חָכְמָה וּבִינָה רוּחַ עֵצָה וֹגְבוּרָה רוּחַ דֵּעַת וְיִרְאַת יְהֹוָה:

ISAIAH 11:1-2

11:1 THEN A SHOOT WILL SPRING FROM THE STEM OF JESSE, AND A BRANCH FROM HIS ROOTS WILL BEAR FRUIT. 11:2 THE SPIRIT OF THE LORD WILL REST ON HIM, THE SPIRIT OF WISDOM AND UNDERSTANDING, THE SPIRIT OF COUNSEL AND STRENGTH, THE SPIRIT OF KNOWLEDGE AND THE FEAR OF THE LORD. (NASB)

Notice Isaiah is speaking prophetically of the Messiah, of a future time. Isaiah says the Lord will place upon his Messiah a spirit of wisdom, a spirit of understanding, a spirit of power, of knowledge, and of fear. Wisdom, understanding, power, knowledge, fear, and faith are all given from the Lord God Almighty in heaven. Rashi points out the following:

RASHI ON DEUTERONOMY 10:12 PART 1

ועתה ישראל AND NOW, O ISRAEL, [WHAT DOTH THE LORD THY GOD ASK OF THEE] — ALTHOUGH YOU DID ALL THIS, YET HIS MERCY AND HIS LOVE ARE EXTENDED OVER YOU, AND IN SPITE OF ALL THAT YOU SINNED AGAINST HIM, HE ASKS NOTHING OF YOU EXCEPT TO FEAR [THE LORD YOUR GOD, ETC.].

When we lay the Glashow resonance phenomenon down alongside of the scripture, we are drawn to this idea of God's transforming power and how great His mercy and love are for us. In the mystical (kabbalistic) approach, the rabbis interpret Mishley / Proverbs 16:28 to say, "as man's sins create a chasm between him and his Creator, so his מצוה His Word, His Love, and His Mercy closes the chasm which existed between man and God." Therefore, in the phrase וְעַתַּה שָׁאָל מֶה יָהוֶה אֱלֹהֵיף שֹׁאֵל מָעְמַף Moshe hints at this interaction in terms of sanctity, where the word מה (What) refers to the presence of God's שכינה (shekhina) in our lives. God's glory in our midst is part of the gospel message that was taught to the nation of Israel in the wilderness. (see Hebrews 4) What is interesting is how every word in the Torah is so rich with meaning and purpose for working powerfully in our lives. And Moshe is teaching us how it is the combination of fear and love that produces genuine reverence for God. As we come to the New Testament, at the cross, we see how God hated sin and how much love He has for you and me. Life from the dead is God's promise and His answer for the problem of sin, demonstrated in the love that He has for us in Yeshua the Messiah. This passage from the Torah (Devarim / Deuteronomy 10:12-13) reveals to us the interconnectedness of both the fear and love of God. And when we approach God in His Word, He approaches us and performs a powerful work in our lives. True faith interconnects

fear and love and what follows is the Revelation of God's majesty and power to transform lives. This was most powerfully demonstrated in the resurrection of Yeshua, so much so, that we too can have that power of newness of life believing in Yeshua, just as Paul speaks about so often. (Romans 6:4)

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