

BIGScience

ISSN 1920-9932 BIG Science (Print)

ISSN 1920-9940 BIG Science (Online)

A major donation to the BIG Little Science Centre Society



A long time supporter of the BIG Little Science Centre Society (BLSCS) the **Chris Ficocelli Family Foundation** donated \$75,000 to the BLSCS last month, adding to the contributions the Foundation has made since 2018.

In photo (left to right):

Gord Stewart - BLSCS Executive Director, Chris Ficocelli, Annette Glover - BLSCS President.

This latest donation brings the total donations from the Chris Ficocelli Family Foundation to the BLSCS to \$225,000 in the past 5 years. Chris has been a big supporter of Gordon Gore's vision of a hands-on interactive Science Centre. We are very grateful for Chris's support. It has played a big part in the BIG Little Science Center's ability to weather the substantial challenges of the past 3 years.

Big Little Science Centre
Newsletter

Issue #383 Jan 2023

In This Issue

Cover **Chris Ficocelli
Donation**

P-1 **Energy From Nuclear
Fusion - Jim Hebden, PhD**

P-3 **Sururus Murphy Joint
Venture and Trans
Mountain donation**

P-4 **Winter 2023 at BIG
Little Science Centre**

P-5 **March Break Camps
2023**

P-5 **space shuttle model
repaired**

P-5 **New BLSCS Board of
Directors**

P-6
We are hiring

Publisher

Big Little Science Centre
Society

Mail: Box 882 Stn Main
Kamloops BC V2C 5M8.

Location: 458 Seymour St.
Kamloops BC V2C 2G6

Phone: 250 554 2572

Website: blscs.org

Newsletter Editor

Big Little Science Centre
E-mail: editor@blscs.org

BIGScience back issues
<<https://blscs.org/newsletters/>>

BIG Little
SCIENCE CENTRE
Explore | Discover | Learn

Energy From Nuclear Fusion

Jim Hebden, PhD

A recent successful demonstration by the United States to produce a sustained fusion reaction has been in the news lately. So, what is nuclear fusion and why is it a big deal?

First, we need to know some terms used when talking about nuclear physics. The three main particles that make up an atom are **protons**, **neutrons** and **electrons**. (Okay, there are actually well over 100 different types of things that can exist in an atom, but that is a story for another time.)

Protons and neutrons are stuffed in the centre of the atom, called the **atomic nucleus** or just **nucleus**. The electrons are outside of the nucleus, like a bunch of moths surrounding a light bulb at night.

Protons have a mass of about 1 atom unit and have a charge of +1.

We represent the proton by the symbol ${}^1_1\text{p}$.

The **superscript** "1" (the number that is **up** and to the left) refers to the mass number (in this case, the mass of one proton)

The **subscript** "1" (the number that is **down** and to the left) refers to the +1 charge on the proton.

Neutrons also have a mass of about 1 atomic unit, but have no charge and are "neutral".

We represent the neutron by the symbol ${}^1_0\text{n}$.

Again, the superscript "1" refers to the mass number (in this case, the mass of one neutron).

The subscript "0" refers to the zero charge on the neutron.

Electrons have a very tiny atomic mass and have a charge of -1.

We represent the electron by the symbol ${}^0_{-1}\text{e}$.

The superscript "0" refers to the mass number of the electron (zero because only protons and neutrons contribute to the mass number)

The subscript "-1" refers to the -1 charge on the electron.

One more term is needed: **isotope**. An isotope is an atom that has a different number of neutrons in the nucleus. For example, the simplest element, hydrogen, has three isotopes:

${}^1_1\text{H}$ is ordinary hydrogen and makes up 99.985% of all the hydrogen on Earth. It has one proton and no neutrons in its nucleus.

${}^2_1\text{H}$ is called **deuterium** (or heavy hydrogen) and contains one proton PLUS one neutron in the nucleus, resulting in a mass number of 2. Since deuterium has a different number of neutrons in the nucleus, it is an **isotope** of hydrogen. Deuterium makes up 0.015% of all hydrogen on Earth.

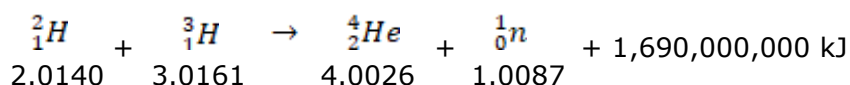
${}^3_1\text{H}$ is called **tritium** and contains one proton PLUS two neutrons in the nucleus, resulting in a mass number of 3. Tritium is very radioactive and decomposes at such a rate that half of a sample of tritium decomposes in about 12 years. (By comparison, the most common isotope of uranium takes 4.5 billion years for half of a sample to decompose.)

Now that we can talk like a physicist, let's look at two types of nuclear reactions: **fission** and **fusion**.

Present-day nuclear reactors produce energy by the process of **nuclear fission**. In a fission reaction, an unstable radioactive atom either spontaneously blows itself apart into smaller radioactive fragments or is struck by an incoming high energy neutron that in turn blows the atom apart into smaller fragments. This fission process creates a tremendous amount of energy, thousands of times more than the energy released by a chemical explosion. The drawback to nuclear fission as an energy source is having to deal with the highly radioactive by-products, some of which can be dangerous for thousands of years. This is not an impossible task, but it is a difficult and expensive task.

Nuclear fusion is quite different from the fission process that breaks down atoms into different, smaller atoms. Let's see how fusion works.

In the fusion reaction which is presently being done by the USA and some other countries, deuterium and tritium are combined to produce helium, neutrons and a massive amount of energy, as shown in the nuclear reaction equation below.



This translates as follows (we will explain the numbers below the equation afterwards): a deuterium atom collides at very high energies with a tritium atom and "fuses" (squashes together) to form a helium atom (2 protons and 2 neutrons) plus one neutron and a huge amount of energy.

The great thing about fusion reactions: there are no nasty radioactive products - just helium, neutrons and energy - lots of it! The downside: fusion reactions require high temperatures and pressures to occur. In addition, huge powerful magnets are required to contain the deuterium and tritium and force them to fuse together. However, once a fusion becomes "self-sustaining", it produces much more energy than was required to get it to start. Some of the energy produced can then be used to help supply the high temperatures and

(Cont. next page)

pressures required to keep it going, while the rest of the energy can be used to supply electrical energy for a power grid. Now let's see how that huge amount of energy is produced by the fusion reaction. The numbers below the above equation, as you might have suspected, are the actual, not approximate masses of the particles.

The combined mass of the deuterium and tritium is $(2.0140 + 3.0161) = 5.0301$, but after the reaction the combined mass of the helium and neutron is only $(4.0026 + 1.0087) = 5.0113$.

This means the products weighed $(5.0301 - 5.0113) = 0.0188$ less. Where did the extra mass go?

Well, Einstein's equation, $E = m \cdot c^2$, tells us that if a reaction loses a mass "m", then if you multiply the lost mass by the square of the speed of light "c", you can calculate the energy "E" produced. If we express the mass as 0.0188 grams, then the calculated energy is 1.69 billion kJ.

To give you a better idea, that tiny loss of 0.0188 gram (about the mass of a grain of rice) gave an energy equivalent to exploding 470 tonnes of TNT! Now can you see why fusion reactions might be a great way to produce energy? They have no hazardous waste products and they produce much more energy than it takes to make the reaction occur.



Surerus Murphy Joint Venture and Trans Mountain donation to the BIG Little Science Centre

Adrian Wall from Surerus Murphy Joint Venture dropped in to present a **\$6,500** donation from the **Surerus Murphy Joint Venture and Trans Mountain employees** working in Kamloops and Merritt area to the **BIG Little Science Centre (BLSC)**.

This is the third year that Surerus Murphy Joint Venture and Trans Mountain has supported the BLSC. Their continued support is very much appreciated.

The BIG Little Science Centre is open to the public

Public Drop-in Hours: Tuesday to Saturday 9:30 AM - 5:00 PM.

Masks must be worn by all guest age 4 and up at all times in the Centre.

Call us at 250 554 2572 for details.

CLOSED SUNDAYS and HOLIDAYS

Phone: 250 554 2572 E-mail Gord@blscs.org or Susan@blscs.org

For more information check out our website (blscs.org), our Facebook page, or follow us on Twitter.

Winter 2023 at BIG Little Science Centre

Join us for astonishing, hands-on science for all ages!
Open Tuesday to Saturday, 9:30am to 5:00pm

Discover the interactive science exhibits in the Gordon Gore Exploration Room (perfect for ages 2 and up), our many shows, clubs, camps, and special activities. We are wheelchair accessible, and a wonderful place for people with different needs. BIG Little Science Centre is a registered charity, dedicated to developing a passion for science in everyone. Masks are required if older than 3; unless unable to be worn.

Incredible Shows and Activities:

Saturday January 21 **Forces and Motion Show** **11:00am & 1:30pm**

Explore some different types of forces that cause movement. Enjoy powerful fun!

Saturday January 21: **Science Booth for ABC Family Literacy Day** **Free entry**

Unplug and Play Week Kick-off at the **Henry Grube Education Centre**, 9:00am to 12:00pm.

Includes loads of activities for parents and children to do together. Children each receive one free book.

Saturday January 28 **LEGO Day!** **9:30am to 5:00pm**

Lego and Megablox will be out for families to build whatever you can imagine.

Tuesday January 24 to Saturday January 28 **Story Walk with the Kamloops Library**

Free entry. Pick up a map at the downtown Kamloops Library then take a walk downtown to read the story. Bring your completed story map to BIG Little Science Centre to answer some questions, win a prize, and receive free entry into the science centre. **10:00am to 5:00pm.** questions@tnrd.ca or 250-372-5145

Friday February 3 **District Professional Development Fun for Families**

LEGO all day! **9:30am to 5:00pm**

Spectacular Static Electricity Show **11:00am & 1:30pm**

This exciting interactive Static Electricity Show is a true hair raising experience.

Saturday February 4 **Spectacular Static Electricity Show** **11:00am & 1:30pm**

This exciting interactive Static Electricity Show is a true hair raising experience. Discover static electricity and be wowed by the Van de Graaff Generator's static power and tricks! A fantastic family show.

Saturday February 11 **Awesome Air Pressure Show** **11:00am & 1:30pm**

Air is a force of nature that demands respect; join us for this interactive show to learn why!

Become a member of the Big Little Science Centre Society

A family membership is \$70.00/year. An individual membership is \$45.00/year. A family membership consists of five directly related people. (This includes any combination of grandparents, parents and children).

Visit our website blscs.org for more details on the benefits of membership.

March Break Camps 2023 - Registration Now Open!

March Super Wow Science Camp 1, Monday March 20 to Friday March 24, 9am to 3pm, Children must be in grade 1 or higher: Cost \$ 225.00: Registration Form can be found on our website blscs.org

Enjoy hands-on science activities mixed with games, experiments, crafts and art. Active science learning allows a child's brain to discover the world around them while their body is busy. Fun STEAM (Science, Technology, Engineering, Art, and Math) science at its best.

March Super Wow Science Camp 2, Monday March 27 to Friday March 31, 9am to 3pm, Children must be in grade 1 or higher: Cost \$ 225.00: Registration Form can be found on our website blscs.org

Enjoy hands-on science activities mixed with games, experiments, crafts and art. Active science learning allows a child's brain to discover the world around them while their body is busy. Fun STEAM (Science, Technology, Engineering,

The **space shuttle model** was recently repaired and upgraded by **Howard Grieve** (right) a BIG Little Science Centre volunteer .

Howard repaired some portions of the model, upgraded the labels and added some new parts.

Howard's support for the BLSC is very much appreciated.



The latest **BIG Little Science Centre Society (BLSCS) Annual General Meeting (AGM)** was November 14, 2022. In case you missed it here is the listing of the new Board of Directors of the BLSCS that were elected.

Board Executive:

Annette Glover - President
Terry Lake - Vice-President
Doug Bickley - Treasurer
Lianne Milobar - Secretary

Board Directors:

Domenic Comita	Mike O'Reilly
Jennifer Gore	Raffelina Smith
Natasha Little	Andrew Watson

BLSC Wish List

Would you like to help out the Big Little Science Centre?

Here is a wish list of donations we are looking for:

A Dish Washer in good working order for our kitchen area

Any Lego[™] Mindstorms parts

Plastic photo film canisters

We are Hiring!

Assistant Operator Position

The Organization

In February 2000, Gordon R. Gore, a retired science teacher who had dedicated his life to teaching science in an interactive environment, started the **BIG Little Science Centre** (BLSC). The Centre currently operates out of an 8,400 sqft building in downtown Kamloops. The current program format allows visitors a period of time to experiment on their own at any of 120-plus hands-on stations located in the main room. Two other rooms are used for demonstrations and as basic teaching laboratories.

In October 2002, the **BIG Little Science Centre Society** (BLSCS) was established and was registered as a charitable organization in September 2003. The Society has a leadership of volunteer directors who meet monthly. The current volunteer Board represents a diverse range of experience and skills including education, accounting, engineering, business, science and the trades. Many dedicated volunteers help to run the science centre, donating over 2000 hours of service per year. Further information about the Centre can be found on our website at <http://blscs.org>.

Position Overview

Now in its 21st year, the organization is poised to hire a third staff member. We seek to hire a permanent part-time (2-4 days/week) **Assistant Operator** who could potentially move into a permanent full-time **Operator** position. This position is for someone who can continue driving our Vision and Mission forward, growing the organization's impact and reach, and continuing the Science Centre's busy day-to-day operations. Over time, the Assistant Operator is expected to assist with building upon BLSC's program areas, and further establishing the BIG Little Science Centre as a destination for fun interactive science and science education.

The Assistant Operator will assist with the strategic and operational responsibility for the BIG Little Science Centre's programs, expansion, and daily operation. This position reports to the Executive Director and the Operator.

Application Process

Application package must contain a cover letter, resume and at least two (2) professional references, including contact information (email and phone number).

Submit the application package to Gord Stewart, Executive Director, via gord@blscs.org or Box 882 Station Main Kamloops BC V2C 5M8

The Big Little Science Centre will accept applications until **February 25th, 2023 at 11:59 pm.**

Diversity Statement

The BLSC is an equal opportunity employer that is committed to creating an inclusive environment for all employees. All qualified applicants will receive consideration for employment without regard to age, race, color, religion, sexual orientation, sex (including pregnancy and gender identity), national origin, political affiliation, marital, parental, disability or veteran status, or other applicable legally protected characteristics.

More Information:

Web: blscs.org

Or

Email: gord@blscs.org