NOVA
NEWSLETTER OF THE VANCOUVER CENTRE RASC
VOLUME 2012 ISSUE 1 JANUARY FEBRUARY 2012

The Cabin in the Sky Observatory:
How astronomy changed everything for one lucky family
by Howard Trottier

(Part two of three)

On May 12/13 of 2010, I was fortunate to realize a dream shared by many amateur astronomers. I took first light from an observatory that I had built at a remote get-away, and which by certain providences I was able to equip with first-rate gear. I could now capture the deepest of deep-sky treasures.

As I recounted in the first part of this story (which appeared in the March/April 2011 edition of NOVA), the dream had its first stirrings in my case at summer camp, when I was about 12 years old. I owe so much to a camp counsellor, whose name I can no longer remember, who introduced the glory of the night sky to a group of us, the nerdiest kids in the camp. I became obsessed with observing, especially deep-sky objects. I endlessly poured over reference books and star charts to prepare target lists, and to come up with strategies for how I might find those celestial treasurers from the sidewalk in front of my parents' home, under the heavily light-polluted skies of urban Montreal. I learned by doing, saving money from paper routes to buy two telescopes (with help from my parents). And all the while I dreamt about building my own observatory, equipped with "serious gear," and located infinitely far from city lights; a place to which I would escape to plumb the deepest of skies.

First light images with a CCD camera

After high school, "recreational" astronomy all but disappeared from my life. When I would occasionally think back to the time when I had been consumed by the pursuit of the next deep-sky wonder, I was puzzled at how that dream, once so present, now seemed so removed. But it must have been there all along, just under the surface, waiting for the right time and trigger to return to the fore. And when it did, I had a family, and that dream would change everything for all of us.

The trigger came in the spring

continued on page 2

JANUARY 12 — UBC
Prof. Ray Jayawardhana of the University of Toronto: Rocks, Ice and Penguins: Finding Meteorites in Antarctica

FEBRUARY 9 — HRMSC
Dr. Ed Krupp, Director of the Griffith Observatory: Time's Up: 2012 and the Maya Calendar

MARCH 8 — UBC
Dr. Catherine Johnson of UBC Earth and Ocean Sciences: The First Results from MESSENGER at Mercury

continued from page 1

of 2007. I had been teaching Introduction to Astronomy at the Simon Fraser University physics department for several years, and it seemed like a good idea to give

The second night: Saturn

the students the chance to do a bit of observing. I was not intending to do any serious astronomy for myself. My goal was to give my students the opportunity to directly experience some of the celestial wonders that they were only hearing about in the classroom.

I persuaded my Chair that we needed a new telescope. So, on behalf of the department, I ordered a Meade LX-200 8" telescope, through Vancouver Telescope. On a last-minute whim, I decided to add a small CCD imager to the order, the Meade DSI (about 0.5 megapixel, colour one-shot version). I had a vague idea that CCD cameras were a leap forward over the earlier era of film emulsions, but was completely unaware of the renaissance that was taking place in amateur astrophotography. When I would occasionally look at the stunning images that appeared on Astronomy Picture of the Day, I had no idea that "amateurs," using their own equipment, produced many of the most beautiful portraits.

The depth and scope of astrophotography would be the trigger. Soon, I would be caught up in a revolution being driven by new and relatively affordable large-aperture telescopes, with optical systems designed for razor-sharp imaging over huge fields, carried by mounts of stunning mechanical precision, and CCD cameras specially designed for astronomy, along with powerful software for running the control systems and processing the results. But in March 2007, when the SFU gear arrived, I had no inkling of what I was getting into.

Within days, after trying out the new gear on downtown buildings in the daytime from my living room, I had my first evening of astronomical imaging. I was pretty ambitious, going for the Orion Nebula and Saturn, with disappointing results, before settling that night on an easier target, the Moon. But now I was hooked. By early April, my technique improving, I got a reasonable image of Saturn.

Within a month, I was getting colour images of deep-sky objects that had transfixed me as a kid, including the Whirlpool Galaxy and the Ring Nebula (notice the out-of-focus stars in that one!). I was stunned at what was possible with relatively modest equipment, even for a newbie, and in the heavily light-polluted skies of urban Vancouver no less. Imagine, capturing the spiral arms in the Whirlpool, and the 15th magnitude white dwarf at the centre of the Ring Nebula, from the city, in just minutes of exposure! The passion had returned, full bore.

By the fall, I was routinely imaging at SFU, first for students in my Astronomy course, and then more broadly for members of the public, who would attend star parties under the banner of "Starry Nights @ SFU" (but that's another story). One of the first images that I shot at SFU was that October, of Comet Holmes, looking like a cosmic bowling ball, with some students from my class watching the frames downloading "live."

Meanwhile, I had been thinking

continued on page 6

M51, the Whirlpool Galaxy (left) and M57, the Ring Nebula (right)

President's Message

by Howard Trottier

On behalf of the RASC Vancouver Centre Council, and on the occasion of the publication of this, our first edition of NOVA for 2012, I would like to extend best wishes to our members and public for a happy and fulfilling New Year, one that includes an abundance of astronomy in all of its forms, especially clear skies!

If you are reading a hardcopy of this edition of NOVA, then you quite likely picked it up at our first public lecture of the year, which is being held at the UBC Hennings Physics Building. We will be hosting Prof. Ray Jayawardhana, Professor and Canada Research Chair of the University of Toronto, for our January 12 lecture. Prof. Jayawardhana's presentation is entitled *Rocks, Ice and Penguins: Searching for Meteorites in Antarctica*. Be sure to look elsewhere in this edition of NOVA for a backgrounder on our speaker, who has been hailed by Wired Magazine as "a rock star" of astronomy!

This lecture promises to be just the start of another year of presentations by A-list speakers on a diverse range of topics! Our top-flight speaker program is one of the great strengths of RASC Vancouver's programming,

continued on page 4

About RASC

The RASC Vancouver Centre meets at 7:30 PM on the second Thursday of every month at various locations in Metro Vancouver (see page 1 for meeting locations and page 4 for maps). Guests are always welcome. In addition, the Centre has an observing site where star parties are regularly scheduled.

Membership is currently $73.00 per year ($41.00 for persons under 21 years of age) and can be obtained by writing to the Treasurer at the address on page 5. Annual membership includes the invaluable Observer's Handbook, six issues of the RASC Journal, and, of course, access to all of the club events and projects.

For more information regarding the Centre and its activities, please contact our P.R. Director.

NOVA, the newsletter of the Vancouver Centre, RASC, is published on odd-numbered months. Opinions expressed herein are not necessarily those of the Vancouver Centre.

Material on any aspect of astronomy should be e-mailed to the editor or mailed to the address below.

Remember, you are always welcome to attend meetings of Council, held on the first Thursday of every month at 7:30pm in room P8445.2 of the Physics wing of the Shrum Science Centre at SFU. Please contact a council member for directions.

2012 Vancouver Centre Officers

President Howard Trottier
presendent.rascvancouver@gmail.com

Vice-President/Secretary Alan Jones
secretary.rascvancouver@gmail.com

Treasurer/Telescopes Steve Coleopy
treasurer.rascvancouver@gmail.com

National Rep./LPA Mark Eburne
national.rascvancouver@gmail.com

Librarian William Fearon
library.rascvancouver@gmail.com

Public Relations Scott McGillivary
pr.rascvancouver@gmail.com

Membership Ciara Morgan-Feir & Rohit Grover
membership.rascvancouver@gmail.com

Events Suzanna Nagy
events.rascvancouver@gmail.com

Education Bill Burnyeat
education.rascvancouver@gmail.com

AOMO Chair Leigh Cummings
aomo.rascvancouver@gmail.com

Webmaster Harvey Dueck
webmaster.rascvancouver@gmail.com

NOVA Editor Gordon Farrell
novaeditor.rascvancouver@gmail.com

Observing Oleg Mazurenko
observing.rascvancouver@gmail.com

Speakers Barry Shanko
speakers.rascvancouver@gmail.com

Merchandise Diedre Sportack
merchandise.rascvancouver@gmail.com

Deputy IT Steve Meighan & Jonathan Neufeld
it.rascvancouver@gmail.com

Councillor Jim Ronback
jim.ronback@gmail.com

Honourary President Dr. John Macdonald

Trustees Sally Baker & Ron Jerome

Library

The centre has a large library of books, magazines and old NOVAs for your enjoyment at the GMSO. Please take advantage of this club service and visit often to check out the new purchases. Suggestions for future library acquisitions are appreciated.

On the Internet

http://rasc-vancouver.com or
http://www.rasc.ca/vancouver

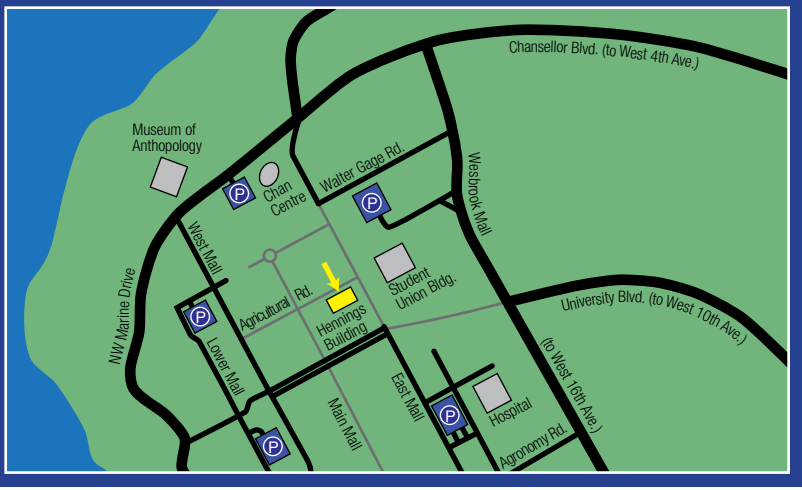
Details of upcoming meetings and events can be found on Meetup:
http://astronomy.meetup.com/131/

Mailing Address

RASC Vancouver Centre
1100 Chestnut Street
Vancouver, B.C.
V6J 3J9

604-738-2855

Maps to Meeting Sites



UBC

Our UBC meeting site is in room 201 of the Hennings Building. The main entrance is off Agricultural Rd. (indicated by the arrow on the map at left). Room 201 is up the stairs and on the left.

Pay parking is available at several parkades located around campus (indicated as "P" on the map).

continued from page 3

but is just one of our many services that benefit our members, and which contribute to the community at large.

If you are a member of RASC Vancouver, then you probably already know the broad outlines of the other priorities that council has set for our 2012 programming, which we have carefully chosen in order to effectively concentrate our efforts in four key types of activity: Public outreach; Observing Programs; Membership Building; and Web Presence. Council has set specific goals within each of these four areas, whilst we keep on the lookout for other opportunities that may arise during the course of the year.

For outreach, we intend to invest in our partnerships with the SFU Observatory (coming soon to a Burnaby campus near you!) and the BCIT Planetarium, including using these venues to reintroduce our very successful "What's Up?" program for newcomers to astronomy (especially young ones!). The "What's Up?" program was established last year as an "add-on" to our monthly lecture series, but will instead be offered this year a series of special events, independent of our speaker program, so as to better serve a young audience.

To reinvigorate our observing program, we will establish a regular series of observing nights, using Twitter to link participants to these events in real time (more on Twitter below), along with a series of clinics on telescope use, astrophotography, and other areas of interest (looking to our members for direction here). We will also continue to improve access to our valuable observatory, the AOMO in Maple Ridge.

To build our membership, we will survey members and our many non-member guests to establish what we need to do to bring more value to our existing membership, and to entice newcomers to our society. The June 5 transit of Venus promises to be a extraordinary opportunity to showcase Vancouver Centre to a large public audience, allowing us to highlight the expertise of our membership with appearances on local TV and radio broadcasts, and in interviews by print media, and accentuating our capacity for community engagement by a massive show of force on event day! We are already gearing up for this fabulous occasion! If you are a member of Vancouver Centre and are interested in becoming involved in our public presence, there is no better way to do so than by contributing to our Venus transit effort, and no better time to step forward than now! I heartily encourage you to contact Vancouver Centre's Event Coordinator, Suzanna Nagy, at events.rascvancouver@gmail.com.

Turning to our fourth and final priority for 2102, which is to improve our electronic presence, we will establish Facebook and Twitter as prime social networking tools (in addition to our successful

continued on page 6

Gemini

by Bill Burnyeat

The richest, neatest and—in many ways—the best of the winter constellation is the twins. Why am I so hot on Gemini since I was born under the sign of the bull? It's simply this. Gemini is one of the special 12 constellations of the zodiac and one of a circle of starry assemblages that defines the roundish ring of the Milky Way. This band of light intersects the zodiac in two places. Once in Sagittarius and Scorpio in the southern summer sky, and at a second place within Gemini in the north; the stream is more narrow here and only wide enough for one constellation.

In early thinking about the sky, we sometimes meet with the notion of the Milky Way as the original path of the ecliptic but then there was a calamity, battle of the gods, cosmic anger at human misbehaviours and whoops the whole thing fell out of order and assumed its current imperfect way. It's the logic of simplicity and harmony applied to the visible aspect of the skies. The only unknown was which god had engineered the current mess upstairs.

Beliefs all over the cultural map back up this idea of the Milky Way. Early Greeks, Romans and some first nations groups believed the souls of the dead journeyed on the Milky Way, just as the Moon rides the ecliptic. A soul got into the galactic assemblage at Gemini, sort of like a bus stop in the sky. Souls sailed down the pale band of light to emerge at the bottom, in Sagittarius. There were no stops on the way, so perhaps the bus had a "sorry" sign on its front. The entrance and exit, of course, are the intersections of the galactic and ecliptic paths. Although the idea doesn't get much credence today, it's interesting to note that this must have been worked out by

continued on page 10

Loaner Telescope Program

by Steve Coleopy, Director of Telescopes

As many of you have read in previous editions of NOVA, you will know that we have a loaner telescope program. There are a number of telescopes that we have ready for any member to borrow for a month at a time, at no charge. Normally, these telescopes are signed out after our monthly meeting at the Space Centre. However, because our meetings will be held mostly at other locations for the foreseeable future, borrowing and returning telescopes is going to be a little more difficult.

As mentioned in our last edition of NOVA, we are trying to not inconvenience our members by preparing a reservation system where members can reserve one of our loaner telescopes, then pick it up from and return it to wherever the monthly meetings are being held.

We are making progress with the new reservation system, but it isn't ready yet. Until then, either see me at one of the monthly meetings, or email me with your request at telescopes.rascvancouver@gmail.com. Keep checking back to our web site at www.rasc-vancouver.com. We should be up and running very soon. ✸

Membership has its Privileges!

New members, did you know? The Vancouver Centre has 8 telescopes available for loan free of charge! We have telescopes ranging from 60mm to 10" diameter. For more information see the Director of Telescopes in the meeting room of the GMSO after the members meeting. All telescopes are to be picked up and returned at the GMSO. The loaner period is for one month, to be returned after the next meeting. Telescopes are not allowed to circulate outside of these meetings. You can now reserve two different telescopes per year and use what is left at the end of the meeting anytime.

Your greatest opportunity as a member of the RASC is to take advantage of the company of other enthusiasts to increase your knowledge, enjoyment and skill in astronomy.

The best thing you can do to gain the most from your membership is to get active! Take in the club meetings; engage other members with questions; come out to observing sessions (also known as "star parties"), and, by all means, volunteer to take part in our many public events.

For the usual observing sites and times, visit our website at http://rasc-vancouver.com/observing-sites/ or contact the Observing Chair at observing.rascvancouver@gmail.com.

Upcoming Events

February
11 – Dr. John Grunsfeld, Deputy Director, Space Telescope Science Institute and Former NASA Astronaut: A Hubble Adventure: Repairing the Telescope and Its Exciting New Discoveries.

http://vaninst.ca/VbGrunsfeld.html

March
TBD – Night Quest at Pacific Spirit Park

April
28 – International Astronomy Day

June
5 – Transit of Venus

August
Aug. 11 - 19 – Mt. Kobau Star Party

September
Sept. 8 - 15 – Merritt Star Quest

December
8 – AGM

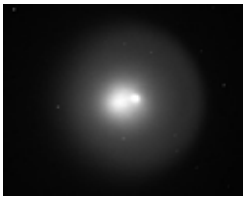
continued from page 2

deeply about getting my own equipment for "serious" imaging; something portable, with a mount that could properly carry its payload with good tracking, and a more sophisticated camera.

It was the fall of 2007. Within a year, everything would change for my family and me. ✸

(to be continued)

Comet Holmes



continued from page 4

Meetup site), especially for linking our members in real time, and we will increase content on our much improved web site, http://rasc-vancouver.com.

RASC Vancouver Centre also has an important new challenge in 2012. This concerns a central part of our efforts, which, as I described at the top of this column, is to provide a monthly speaker to our membership and the general public. Over the past 40 years, our venue for these meetings has been the HR MacMillan Space Centre, where we were not charged for meeting space. Owning to a difficult financial situation, the Space Centre will now charge its standard rate for nonprofit organizations, of $640 per meeting. Council has unanimously agreed we cannot afford this fee without serious compromise to the rest of Vancouver Centre's efforts.

Fortunately, we have much less expensive alternatives that we can use while we look for a longer-term solution. We have already made ongoing arrangements with SFU and UBC, which will provide us with meeting space at minimal or zero cost, and with BCIT, which has economical rates, and which suits our priorities for this year. The Space Centre will continue to offer us free use of the auditorium for speakers that they think will appeal to a broad enough segment of their audience. The Space Centre has also pledged to revisit our relationship once they return to fiscal health.

At this point, we have established the venues for the first three lectures of 2012, which all promise to be of outstanding quality, and on exciting and timely topics. Following our January 12 lecture at UBC by Prof. Ray Jayawardhana, our Thursday February 9 presentation will be at the Space Centre, where we will host Dr. Ed Krupp, Director of the Griffith Observatory in Los Angeles, and our Thursday March 8 lecture will return to UBC, where will we host Dr. Catherine Johnson of the UBC Department of Earth and Ocean Sciences, and a member of the MESSENGER spacecraft science team. For April and beyond, locations will be announced as soon as we have determined the venues. Notifications will be sent to membership by email, and will be posted on Meetup. In general, please consult our Meetup site on a regular basis for more information as it becomes available: http://www.meetup.com/astronomy-131.

Finally, all of us council would like membership and our public to know that we are actively working on an opportunity to establish a new permanent base of operations, one that may turn out to be remarkably close at hand.

There is much to look forward to in 2012 at RASC Vancouver! All of us on council look forward to you at more of our monthly lectures, and our many other events. ✸

Howard Trottier
President, RASC-Van
Professor of Physics, SFU

Go to — go to!

by David A. Rodger

"Aye, fashion you may call it. Go to, go to!" (Polonius, *Hamlet*, Act I, Scene iii)

I still remember my shock some 10 years ago when I learned that a friend, who had shown no previous interest in astronomy, had purchased a small Maksutov telescope with a "go-to" system. She didn't know her way around the sky; I doubt if she could have distinguished Orion from the Big Dipper. Yet, by pressing a few buttons on the instrument's hand control, she could be looking at, and tracking, the Andromeda galaxy, Perseus' double star cluster or Saturn.

Notwithstanding my disdain, two years later I, too, had a telescope with a "go-to" system. What was it that changed my perspective?

I learned my way around the sky on the Saskatchewan prairie. There, under ideal conditions, I could see the constellations with their galactic and nebulous treasures in their entirety from horizon to horizon. Most of us today can't do that. For one thing, light pollution in Metro Vancouver, Abbotsford and Chilliwack is a huge and growing problem. Add tall buildings, mountains and trees to the mix and our view of the sky is severely restricted. Urban-based "star-hopping " (the method by which we move from star to star in search of deep sky objects, double stars and faint galaxies) is a frustrating challenge. From my present observing site in North Vancouver, I see only fragments of constellations and, more often than not, the target is obscured by some obstacle. I'm sure you recognize the experience.

There's another factor that attracted me to a go-to system. Our backs and necks can take only so much twisting and lifting. Astronomy seems to require quite a bit of both, particularly in the case of large Dobsonian reflectors. Young necks and backs can tolerate a certain amount of this, but as we get older, bones and muscles tighten. When we force them into odd positions (such as peering through an optical finder attached to a long Newtonian reflector aimed near the zenith) we are asking for trouble. Go-to systems solve these issues magnificently. And, unless "the hunt" is part of the observing experience you feel you must have, a go-to system means you'll spend a lot more time looking at stars, planets, nebulae and galaxies than looking for them.

There are two distinct families of go-to systems. My Celestron CPC-1100 Schmidt-Cassegrain employs the most sophisticated go-to system because it is on an alt-azimuth mount, functionally comparable to the Dobsonian mounts familiar to many of us. Once an object is found, the computer contained within the hand control sends a constant stream of signals to the telescope's motors and gears telling them just how much to move up or down, left or right, to compensate for the earth's rotation and its effect on the sky.

My TeleVue NP-127 and Orion EON 120mm refractors also rest on go-to equipped alt-azimuth mounts. But there the similarity with the CPC system ends. With TeleVue's "Skytour" system, you do the work; there are no motors or gears involved. Once you've selected the object you want to look at, the readout on the control box displays red-illuminated azimuth and altitude numbers it obtains from encoders placed on the mount's two axes. As you move the telescope, those numbers change. If you are pushing or pulling the telescope in the proper direction the numbers diminish until they reach "zero." At zero your target should now be visible. The system is quick and easy to set up and use.

A decade ago I'd all but given up observational astronomy, at least in the city. So, I give full credit to my go-to telescopes, especially the refractors. Not only did they revive my interest in astronomy, but they've enabled me to see countless deep-sky objects that I would never have found using traditional search methods. My neck and back are grateful, too.

"To go-to or not to go-to; that is the question." (Apologies to William Shakespeare) ✸

Star Odyssey: Joseph Pearce and the Milky Way

by Bill Burnyeat

The Vancouver centre of the RASC, your centre, has received a sizeable endowment from the Pearce family estate. It seems timely to supply answers to members who probably know little about our benefactor and may wish to know more.

Joseph Algernon Pearce was born in Brantford, Ontario on Oct. 7, 1893. When the Great War came, Pearce enlisted in the Armed forces (1915) and served in France where he attained the rank of Major. He was injured, returned to Canada, and finished the war years as a training officer. He attended the University of Toronto where he earned both a Bachelor and Master's degree. After this, he studied at the Lick Observatory in California and earned his Doctorate from the University of California in 1930. It was shortly after this that Pearce came to the Dominion Astrophysical Observatory here in British Columbia.

At this point it may be wise to break off a chronological narrative and review the state of knowledge of the Milky Way galaxy when Pearce was a young man. It's only by appreciating what the galaxy seemed to be like in Pearce's youth can we understand the thrust and motives for his choice of topics and objects for inquiry. In Astronomy books from the late 1800s, volumes Pearce probably read as a boy, the old Herschel "stratum theory" of the Milky Way was maintained. This picture, the result of crude naked eye star counts, showed the galaxy to be in the shape of the letter "y" with the sun and earth situated at the middle where the fork in the "y" diverges. The whole galaxy might be three or four thousand light years across and could contain 50 million stars.

The reality of external galaxies was placed in doubt. Many saw the spiral nebula as the place where a single new star was forming and the spiral arms might be newly emerging planets. The Andromeda galaxy was thought to be certainly not more than 100 light years away, although, frustratingly, its parallax, which should be apparent at

continued on page 9

Speaker Bios: Ray Jayawardhana and Ed Krupp

by Ciara Morgan-Feir

Since his arrival on the astronomy scene, **Ray Jayawardhana** has been a prominent figure. He received his B.Sc. from Yale in 1994 and his Ph.D. from Harvard soon after.

As a graduate student, Dr. Jayawardhana led one of the two research groups that made a discovery around the young star HR 4796A: a dusty disk surrounding it with a large inner hole, which was suggested to have been carved out during the formation of planets. Since this discovery, Dr. Jayawardhana's research group has conducted significant research into brown dwarfs. The group established that young brown dwarfs undergo a T Tauri phase. Recently, Ray and his collaborators imaged and spectrographed a likely extra-solar planet orbiting a normal star.

Dr. Jayawardhana is the co-author of over 80 publications in science journals, including articles that have appeared in *The Economist*, *Scientific American*, *New Scientist*, *Astronomy*, and *Sky & Telescope*. He is also the author of two popular science books: Strange New Worlds: The Search for Alien Planets and Life beyond Our Solar System and Star Factories: The Birth of Stars and Planets.

In 2003, he was awarded the Science Writing Award from the American Institute of Physics. He was also the recipient of the Vainu Bappu Gold Medal of the Astronomical Society of India in 2004, and the Early Researcher Award from the Government of Ontario in 2006. He has also recently been named to the Canadian top 40 under 40.

Well known for his promotion of astronomy to the public, **Ed Krupp** has been the director of Griffith Observatory at the University of California Los Angeles for thirty years. Dr. Krupp is an internationally-acclaimed professional astronomer.

Krupp is recognized as an authority on ancient and prehistoric astronomy. He has published several books in the field of archaeoastronomy, including titles such as Beyond the Blue Horizon and In Search of Ancient Astronomies, and four internationally-acclaimed illustrated books for children.

Often focusing on the cultural aspects of astronomy, Dr. Krupp has written hundreds of articles for the general public and was a contributing editor for *Sky & Telescope* magazine for many years. The telecourse "Project: Universe," which Dr. Krupp hosted, has been televised all over the world.

Dr. Krupp has been the recipient of several notable awards from institutions such as the American Institute of Physics and the Astronomical Society of the Pacific. ✸

continued from page 8
that close range, was for some reason not attained. There were a few sceptics. In 1885, a nova was seen in the middle of the Andromeda nebula. Some pointed out that if the star was within the cloud this undercut the status of M31 as a mere nursery for one star. Others wished to hold on to the old theory and claimed the nova was a background star sitting in the nebula by an unhappy coincidence. Fundamental to all these ideas was that they emerged in an environment which lacked good empirical data on anything except a handful of obvious stars.

In order to make headway on these problems a new type of observatory was needed. The old and small refractors, suitable for double star measurements and planetary work, were not up to the task of sustaining a program of modern astrophysics. What was needed were very large light-gathering elements and the retirement of the observer at the eyepiece in favour of cameras, spectrographs and other electronic data recorders. This is why the Dominion Astrophysical Observatory was built. Pearce was one of the young astronomers attracted here. He was appointed assistant director of the DAO in 1935 and served as director from 1940 to 1951. It was the description and nature of the Milky Way galaxy, in a form recognizable today, that was the principle achievement of these years.

The story of the discovery of the nature of the galaxy is not often told. It involves the appreciation of a small amount of complexity, which the contemporary mind seems to fly from as though from a contagious disease. Everyone knows that Galileo built and used a telescope. But with Pearce we encounter radial velocities of O and B type stars. Hmmm. This isn't something that's a topic on *Oprah*.

To press ahead, let's indulge in a mind experiment. Imagine an observer equipped with an angle-measuring device like a nautical sextant or a ruler held to the eye at a precise distance. Next, suppose our observer gets a long piece of rope and cuts out many lengths, all one metre long. The rope lengths are then laid out all around the observer and perpendicular to his location. Using the angle measuring device our investigator observes a rope that appears one degree in length. Instantly, we can locate the distance to this string. The rope is about 57 metres away. This insight comes not from anything to do with the string but is derived from the mathematical definition of a degree. Turning the device to another string we see its half a degree in length. Conclusion? It's twice as far as the first one, or, about 114 metres away. Far off, is another rope which is $1/10^{th}$ of a degree by measure. It must be about 570 metres away. Now while all these strings have been measured, by some bad luck, a bunch of these metre ropes have fallen on a little island surrounded by a moat of water inhabited by ferocious alligators. It's not a problem. To measure the ropes we don't need to risk being gobbled up. Given enough measurements, we can piece together a little map of the island, without ever setting foot there, and deduce its shape and orientation to ourselves. This system, with its ability to find information about alligator-protected or inaccessible places is just what is needed for the study of stellar motions and distances, which must be calculated to learn about the unreachable stars.

The astronomical spectrograph at the focus of the DAO's 72 inch telescope was put to work measuring the motions of stars. The star's light spread out in a rainbow contains features from which the star's velocity in one direction can be obtained. If a tangential motion is also available, then the true motion of the star can be calculated. Pearce published the first detailed spectroscopic analysis of the structure of our Milky Way galaxy in 1935. Using radial velocities of the very luminous hot stars, the DAO team showed that the sun is two-thirds out from the centre of our galaxy and revolves in 220 million years. Pearce studied the velocities of O- and B-type stars—stars which are bright, inhabit the spiral arms, and therefore are better seen over great distances. He also catalogued the observable B stars and found that 40% are double stars, and estimated the temperatures and dimensions of these giant stars when they appear in combinations as giant eclipsing double stars. Slowly, the nature of our spiral galaxy home began to emerge. And it happened, largely, right here in British Columbia. Next time you are under the night sky, look up into the Perseus, Cassiopeia and Cepheus areas of the Milky Way. This is our stellar neighbourhood and the largest cognitive feature that has Earth within its realm. Take a moment to think about Pearce and the DAO.

Pearce was active in the International Astronomical Union, the Royal Astronomical Society of Canada (president, 1940) and the American Astronomical Society (vice-president, 1944-46). Elected a fellow of the Royal Society of Canada in 1931, he was president in 1949. Pearce died in Victoria in 1988. ✸

continued from page 5
observations, and is therefore not completely a baseless fairy-tale, but is suggested by analogy with the true ecliptic and the wanderers within it.

The Milky Way in Gemini is most dense at the feet on the opposite side of the constellation from its two most prominent features—the pair of stars called Castor and Pollux. These stars give the twins its duel aspect. Castor is a true astronomer's star, a gleaming white dot that has revealed some of its secrets to the telescope. High up in Gemini and only 4.5 degrees from its partner Pollux, the other twin in the sky, Castor is a pleasing double star with two colourless or slightly blue-green stars visible in a small telescope. The fainter of the two orbits the primary, and its elliptical path was the first proof that the laws of physics operated outside of our own solar system. Also, each one of the pair is itself made of two stars that no telescope can separate. Castor is the mortal twin whose brother Pollux sought to find after Castor's death. Pollux, an immortal, was told he could only visit his departed brother by giving up his eternal life. He agreed. For this act of bravery both brothers were joined permanently up in the sky as the Gemini twins.

The second of the twins is Pollux. This star is yellowish orange, or some variation on that theme. It makes a pleasant pair in binoculars, and shows the colour contrast of the two stars well. Pollux is the brighter of the two stars, yet has retained the beta (β) or second brightest designation as opposed to Castor's alpha (α). This formerly led many to claim that Pollux was fainter some hundreds of years ago, and has brightened up to surpass Castor in our own time. It's a tempting idea, yet, if correct, it would mean all our modern insights into stellar evolution are radically wrong, and the contemporary Astronomer, while acknowledging many loose ends exist, can't be persuaded that we are so far off the mark. Some other explanation must be examined. There is one that explains the so-called "secular variation" of Pollux. From early times Castor and Pollux have been called so, in this order. In other words, they are never named as Pollux and Castor. The twins form a pair like Laurel and Hardy, Batman and Robin, Salt and Pepper. It's likely this simple reason is why fainter Castor is the recipient of the alpha tag. In other words, its semantics and not star dust that is at issue here.

Gemini has nine open clusters visible in backyard telescopes. The best is M35. This is one of the loveliest open star clusters in the sky. It is one of those objects that seem overflowing with riches. Wonderfully located, it is next to the marvellous orange stars Eta (η) and Mu (μ) Geminorum. M35 also hosts a spectacular, coloured double star; also, a second small cluster sits just outside M35. This cluster has historical associations, too. It was near here that William Herschel discovered Uranus in 1781. M35 is astride the ecliptic, so it entertains planets from time to time as they wander by. Finally, it's one of the easiest objects to find. A very bright cluster of stars, in telescopes it appears that a bag of diamonds has been spilled out onto an endless carpet of black. M35 can be appreciated in a very small telescope and some even claim to have seen it with the unaided eye. The cluster is about one degree across and contains 30 to 40 stars in a rectangular pattern. On one edge is an easy double star with yellow and blue contrasting colours. Just off the field is a tiny patch of light that is NGC 2158. This little cluster is like an M35 copy but about 15 times smaller. It looks like a small nebula in an 80 mm telescope. The whole area is alive with interesting objects.

Further east in the twins is the star delta (δ). This naked-eye star is very near the place the planet Pluto was discovered in 1930. Pluto was demobilized from Planet duty in 2006. Continuing east from delta, about two degrees, the bright planetary nebula NGC 2392 is found. The books say it's just seen in a 60 mm refractor, but, to be perfectly honest, I can't see it in mine. It needs about a six-inch scope, or I need better eyes. Still with the theme of following the ecliptic in Gemini, now go backwards—retrograde, if you will—and west on the ecliptic about four degrees from delta. Using a low power, look around. A very red star called R Geminorum might be visible. This star is a Long Period Variable (LPV). Its spectrum has emission features of interest to the spectroscope user. In older books, it is classified as an "S" type, which means, visually, it appears very red. The star changes in about 370 days from magnitude 6 to fainter than magnitude 13. ✸

Gemini Sights

M35 (left) and the fainter NGC 2158 (lower right)

Image credit:
N. A. Sharp/NOAO/AURA/NSF