OPUNTIA

394

Middle October 2017

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ROCKY MOUNTAIN WAY: CASCADE FALLS

photos by Dale Speirs

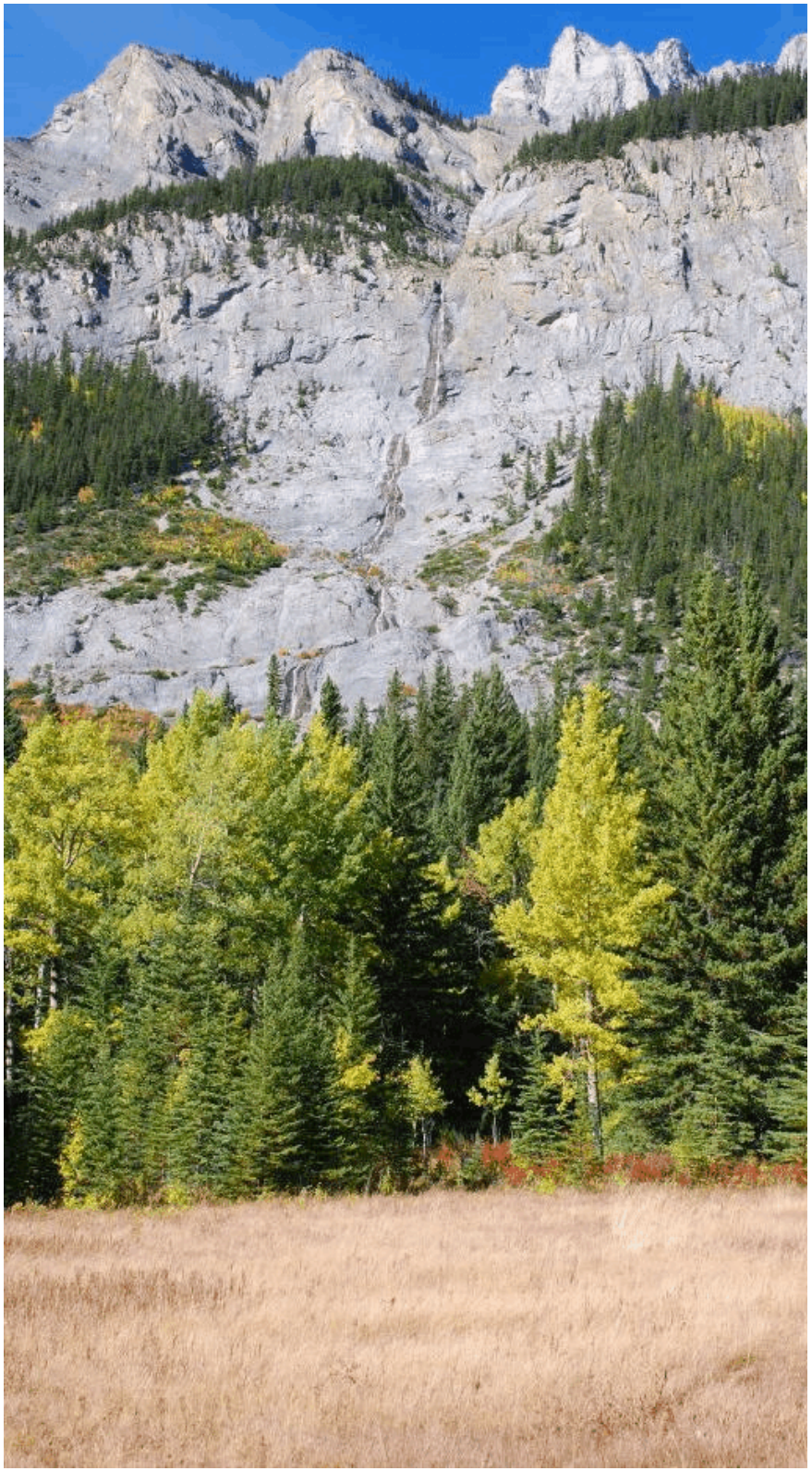
The telephoto at right was taken from the Trans-Canada Highway on May 23, 2017. My list of things to do in Banff National Park included a hike up to the base of Cascade Falls, but as events transpired, it wasn't until September 27 that I finally got back there.

The hike is a short one but a steep one, 45° or more just to the base. I went no further because climbing the cliff requires ropes, something I never do or want to. The following photos are from my September hike, when the falls were drying off.

The springs arise from Cascade Mountain about two-thirds of the way up. They never reach the valley floor directly but instead vanish into the talus (broken rock) slope at the base of the mountain. The water then flows underground and resurfaces on the valley floor as a pond with no apparent inlet or outlet.

I took this photo on September 27 earlier in the day from the cliffs of Tunnel Mountain, looking north across the valley to Cascade Mountain. You don't want to know how I managed the shot.

If you look closely, you can see the lower part of Cascade Falls as a thin line. Most of the falls are hidden in the mountain faults at this angle.



At left: The view from the trailhead. There is no water flowing across the meadow; it is deep underground.

Below: This cheerful sign is at the edge of the trees where the trail begins its ascent. Since I don't hike in the winter, it was no bother to me. However, there have been deaths, both winter and summer, as climbers over-reach themselves or were in the wrong place at the wrong time.

Looking up from the base of the falls.

A close-up showing where the water disappears into the talus.

Side channels of the waterfall.

Looking east from the base of the falls, down the Bow River valley and Trans-Canada Highway. The water from the falls resurfaces in the pond on the valley floor.

Cascade Pond, looking north up the Cascade River valley. In this and the previous photo, and for that matter, most of my previously published mountain photos, you will notice the blankets of spruce forests lining the valleys and mountain slopes.

The pure stands of spruce are not natural. They are a result of a century of Smokey the Bear fire suppression. Photos taken in the pioneer days show patchwork woodlands. There were constant but small fires, and no one worried too much about them unless their log cabin was in the midst.

When, not if, the whole valley goes up in flames in our times, there will be those who will use it as proof of global warming. They evade the issue that the problem is not climate change, which I agree exists, but inappropriate human behaviour. Like people who build beachfront houses on hurricane coasts or bungalows on floodplains. It isn't the weather or climate that is to be blamed.

Parks Canada wardens have been trying to do controlled burns. The difficulty is that the worst areas of past fire suppression and thus the worst future hazards are next to villages or along the highway. Attempts at lumbering bring out the tree huggers, not just figuratively, who shout at the woodsmen to spare that tree.

The scenery looks much the same outside the national parks in the adjacent provincial parks and private land of Alberta and British Columbia. Resorts are built into the spruce forest with no clearance. The houses are wood-frame with pine shake roofs. When they catch fire, they burn like Roman candles.

What is to be done?

The waterfalls are on the southeast corner of Cascade Mountain. Moving north along the Lake Minnewanka road, I took these views of the east side of the mountain (at right) and the northeast corner (below).

RADIO FICTION: PART 9
by Dale Speirs

[Parts 1 to 8 appeared in OPUNTIAs #301, 302, 310, 319, 330, 353, 370, and 377.]

Palaeofiction.

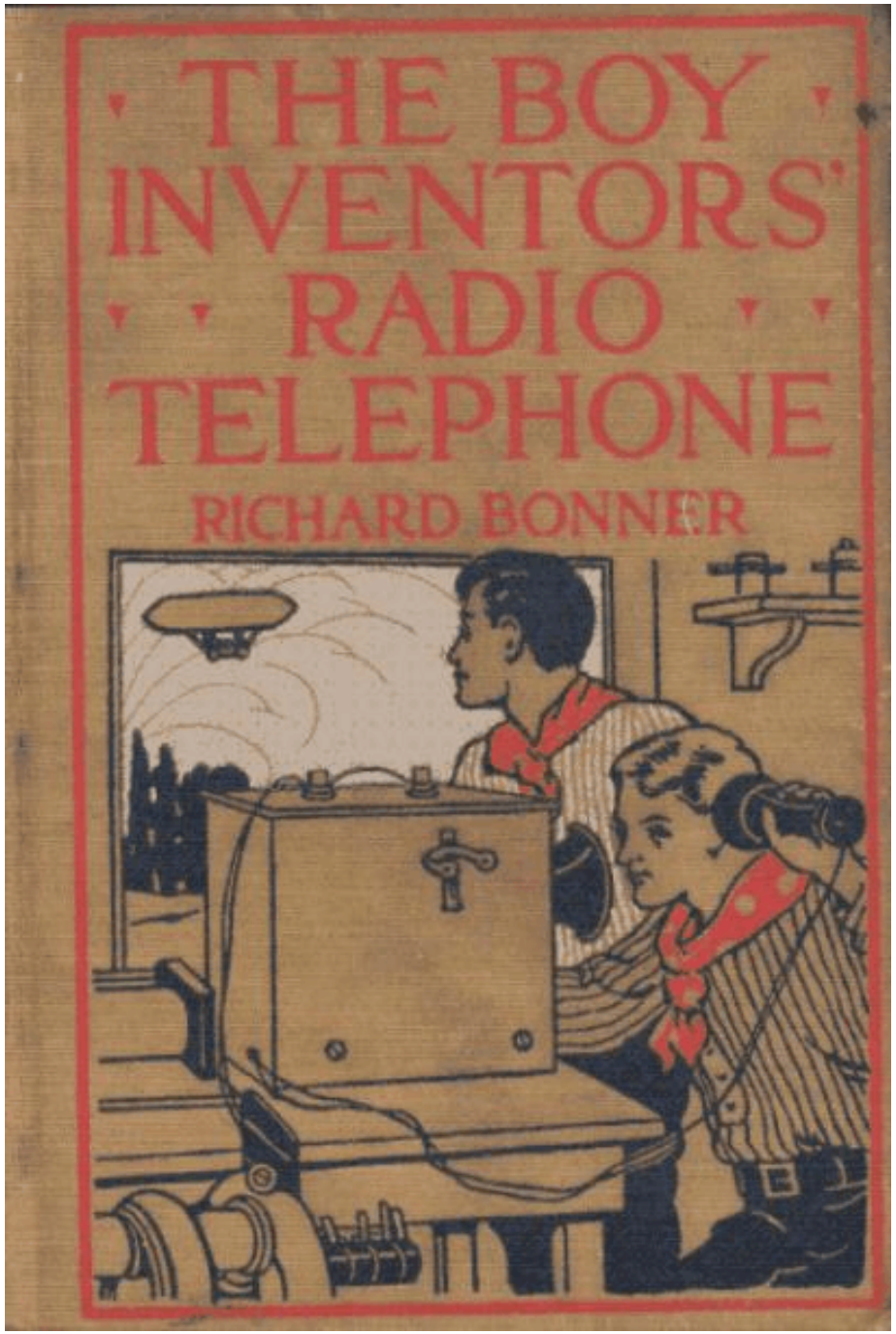
At the dawn of broadcast radio in the 1920s, it was what personal computers were in the 1980s or smartphones in the early 2000s. An exciting time for techies, but few in the general public knew what it was about, and fiction about radio was definitely science fiction.

From the very genesis of radio is the 1915 novel THE BOY INVENTORS' RADIO TELEPHONE by Richard Bonner, part of a series of juveniles available as free downloads from www.gutenberg.org Unlike most juvenile series written under house names, Bonner was apparently a real author, although nothing is known about him.

The novel opens with cousins Jack Chadwick and Tom Jesson trying out their new electric car, which, despite the handwaving explanation, appears to run on a perpetual motion generator. They immediately run into a minor adventure which is too lunatic to explain and involves Professor Jerushah Jenks, who might be a mad scientist were he not a complete idiot. Jack's father Chester is an inventor in the style of Edison, and rich from it, which is why he can afford to indulge his son and nephew.

As was standard with juvenile novels in those days, which all followed the same template, Chapter 2 stops the narrative dead as the author addresses the reader directly and provides plot summaries of the previous novels. The usual supporting characters are introduced, such as the Negro manservant whose Southern accent is so thick it could be cut with a knife: *"Massa Chadwick send me on de bustelbolorium", explained Jupe, who had a vocabulary that was all his own, "for yo' alls to come right away by his laburnumtory."*

Dear Old Dad has invented a device that can transmit voices over distances without wires. *"Looks like some kind of a telephone", ventured Tom.*
"It is a telephone", replied Mr. Chadwick.
"But, but, where are the wires?" asked Jack, glancing about him, "or haven't you connected it up yet?"
"It's connected up as much as it will ever be", said Mr. Chadwick with a smile.
"Can't you guess what it is?"
"I've got it", cried Jack suddenly. "It's a wireless telephone."
"That's right", admitted his father, and, in response to a flood of questions from the boys, he told them how he had been working day and night to bring the device to perfection.



Since radio was little understood by the general public in those days, much less the boys who read novels like this one, the novel stops for a massive infodump from Chester as he explains the theory and practice of radio to the boys. The main problem was lack of range, which Chester thinks he can solve if he had supplies of a substance called Z2X with which to build a more efficient transmitter.

The plot keeps veering about, with adventures in an airship, a cantankerous farmer fed up with his property being damaged by the boys' experiments, a financial panic wiping out the Chadwick fortune, and other assorted travails.

By incredible coincidence, the boys meet up with the one man who knows where commercial quantities of Z2X can be mined. Electricity being a revolutionary technology at the time, the author drags in various innovations so that he can pad out the novel with further infodumps.

As an example, the boys decide to protect their airship from lightning strikes by enveloping it in a Faraday cage and dragging a chain from it in order to ground the electrical charge. This raises obvious questions as to how an airship can go about dragging a long chain over the countryside without snagging or damaging things, and without being so heavy as to pull down the airship.

The Z2X supplies would enable the Chadwicks to mass-produce radio telephones and restore their fortunes. It becomes the MacGuffin of the novel, with lots of chasing about and side excursions whenever the slightest possibility of padding the novel arises. It all works out well in the end for the family and friends, while the bad guys get what they deserve. A fast-paced novel that never moves in a straight line for more than three pages.

THE RADIO DETECTIVES is a 1922 novel by A. Hyatt Verrill, available as a free download from www.gutenberg.org. It sold well enough to initiate a series of books. At the dawn of the radio age, during the American Prohibition era, Tom Pauling, with the encouragement of his parents, is busy constructing radio sets in his home town of New York City.

His father is with a law enforcement agency trying to stop smugglers bringing in alcoholic beverages from Canada and the Caribbean. They can't figure out how the smugglers are landing the stuff. It's almost as if they had some means of sending secret messages to coordinate their landings. Now what could that be, as if the reader didn't know.

Tom and his pals Frank and Henry get busy building a super-radio and are soon intercepting messages from rum-runners. They then take the next step of triangulating the messages using loop antennas, and become full-fledged radio detectives.

Before they ever catch the smugglers, they are diverted into other cases. They invent an underwater radio set for scuba divers and then help their father run a Bolshevist to ground. When that gets dull, a renegade U-boat shows up in the East River, or rather doesn't, being careful to stay submerged. The boys assist their father in catching the crew, a bunch of disgruntled Huns who don't accept the result of the recent War To End All Wars.

The whole mass of plot threads is tied together and justice triumphs. The boys proudly call themselves the Radio Detectives, and are set for as many sequels as the publisher could market. The novels lurch from one exciting adventure to another, with never a dull moment in each episodic chapter.

What's The Frequency, Kenneth?

"Solander's Radio Tomb" by Ellis Parker Butler (1927 June, AMAZING) is about a millionaire (think 'billionaire' in today's currency) who knows his time is coming soon and wants something different for his grave. He first sets up an endowment for a religious broadcasting station, then builds a tomb with loudspeakers that will transmit the station's programmes for the edification of cemetery visitors.

His mistake was to specify in his will that the loudspeakers could only ever broadcast at the specified frequency the religious station was using at the time, and could never be changed. After he is dead and buried, the FCC changes all the frequencies around.

The religious station is moved to a different frequency, while its previous frequency is re-assigned to a low-brow station whose content is mostly barnyard jokes and jazz music (which in the 1920s was equivalent to gangsta rap). So goes away his legacy, and nothing can be done about it because he had written the will in inflexible terms.

"The Great Radio Peril" by Eric Frank Russell (1937 April, ASTOUNDING) is set twenty years into the future. An international conference to allocate radio frequencies for broadcast radio has failed. Every country then takes the obvious

step, jacking up the transmitting power of its stations to drown out its competitors.

At first, it is a matter of annoyance. Manufacturers produce radio sets that can tune to within 2 kilocycles, but still the cross-interference continues. After a while a more pressing problem comes to the fore. Around the world, every nation begins experiencing crop failures. No matter what species, what climate, what nation, the crops are failing. Potatoes, corn, rice, and wheat are dwindling away.

Botanists say that the failures are caused by the massive radio transmissions interfering with capillary flow of water in plant circulatory systems. They are not heard at first, but as the mobs spread, politicians finally take notice. The radio transmitters are taken down one by one, often by vigilantes, and as they dwindle, the following harvest improves.

Not a bad story as such. Today we live in a sea of microwaves (cellphones) and electromagnetism (power lines). No crop failures but no one can say what the long-term effect is on our health and livestock.

"Short-Wave Madness" by Robert Castle (1939 June, SCIENCE FICTION)** is about Dr Gorrel's new radio set that can read human minds. The doubletalk theory behind this device is that thoughts are electrochemical reactions in the brain, radio is a type of electricity, and therefore if you do enough handwaving then you can read other people's thoughts.

It works too. After listening to human minds across the planet, Gorrel aims the radio out into space and listens to alien minds throughout the universe. There seems to be no range problem with this device; the antenna must be very good indeed for a tabletop box.

Gorrel decides to listen in at very low frequencies, in fact, the cosmic ray frequencies. He then discovers that there are super-brains out there made of stars. Each star is a neuron in a galactic brain. The galaxies are constantly murmuring to each other, not just emitting radio frequencies at random. The Milky Way brain suddenly notices Gorrel listening in. It doesn't like that, and reaches out with a special transmission to drive the scientist truly mad.

** SCIENCE FICTION was a pulp magazine published 1939 to 1941.

"Insomnia" is a 1981 episode of CBS RADIO MYSTERY THEATER, written by Elspeth Eric. (Episodes of this series are available as free mp3s from www.cbsrmt.com) A woman suffering from insomnia doesn't know what to do. She isn't going to take pills because they are addictive. The silence of the night oppresses her. She tries other remedies but they fail. The story becomes maudlin as she relives her divorce and all her other failures in life.

A neighbour suggests she turn on her radio to provide background chatter to lull her asleep, and loans her a transistor radio. The problem is that every station on the radio is KYRB, which does not exist on the radio band in her town, east of the Mississippi where broadcast stations have call letters beginning with W. It plays only depressing music. No one else can find it on any frequency. No matter where she turns the dial, she gets KYRB.

The episode is mostly sentimental. It then turns into a wish fulfillment story as her problems solve themselves one by one. The main failing is all the loose threads left hanging. Nothing more is said about station KYRB or any other matter. Set-ups are made, then suddenly dropped without resolution. Not believable.

The Show Must Go On.

"Murder Is My Business" is a 1948 episode of the old-time radio show MYSTERIOUS TRAVELER, written by Robert A. Arthur and David Kogan. (This and hundreds of other OTR shows are available as free mp3s at www.archive.org) Phillips, the writer of a radio detective drama is feuding with Basil King, the producer of the show.

King can't keep writers because of his overbearing temperament. "*Great talent such as myself has always been misunderstood*.", Kings tell Phillips at their first meeting. But the money is good, which Phillips needs, so he signs on. The feuding begins immediately, as King rejects the first script Phillips submits, on the ground that the gimmick used to murder the victim won't work.

It goes on show after show, but Phillips is determined not to quit and let King win. Matters are not helped by the sponsor, a chewing gum manufacturer who is flattered unceasingly by the sycophant King.

Finally Phillips decides to murder King, and begins to contemplate how it should be done. He poisons a stick of chewing gum and feeds it to King right

in the middle of the broadcast. There is a twist ending but it is not plausible. I won't dignify it with a summary.

"Monster Radio" by Chris Roberson (2007, in the anthology THIS IS MY FUNNIEST 2, edited by Mike Resnick) is a talk radio show transcript. The guests are from the political action groups Weird Nation and the Monster Anti-Defamation League. They oppose, you will not be surprised to learn, the negative stereotypes associated with monsters.

Callers to the show include an Egyptian mummy who is skeptical of MADL being able to do anything useful for the undead. The MADL representative gives him a wordy answer that sounds like firm action but is just puff, much like any politician uses to evade a controversial question.

A robot calls in and starts an argument with the Weird Nation guest because it was refused admittance to a Weird Nation meeting. *See, I was turned away at the door. It seems that 'robots', as your staff person so bluntly put it, are not welcome in the ranks of Weird Nation. Now, that's just the kind of fleshocentric nonsense that my kind has been putting up with for decades ...*

To which the Weird Nation guest replies that the reactionary reactor-based cybernetic lobby has been putting hard-working monsters out of work because of automation. The argument becomes hot and heavy, so the talk show host cuts them off and goes to a commercial.

True to life, if you'll pardon the expression. I wonder if George Noory, over at COAST-TO-COAST AM, has read this story.

At right: From the 1937 April issue of ASTOUNDING

LIGHTS, CAMERA, MURDER!
by Dale Speirs

THE DEATH KISS is a 1932 movie based on the novel of the same name by Madelon St Denis (or St Dennis; he kept changing his mind how he wanted the credits to read). It opens on a movie studio set where a gangster movie is being filmed. The particular scene is about a moll fingering the victim for a drive-by shooting. He dies not theatrically but in reality, for someone fired real bullets at him. The defunct, Myles Brent, was a ladies man who left behind a trail of jealous husbands and boyfriends, jilted women after using them for his carnal pleasures, and thus ensured there was no shortage of suspects.

The reaction of the studio executives when they learn of the murder is immediate. As the president of the company remarks: "*Oy, that's gonna cost me a fortune.*" The picture is behind schedule, and the newspaper reporters are slavering all over the story.

Screenwriter Frankyn Drew begins his own investigation, and a good thing too, considering the incompetence of the police. A stray bullet embedded itself in a stage wall at eye level, yet police detectives walk by it without noticing. Studio executives want the death to be declared an accident, and blame the armourer for putting a real bullet into a prop gun.

The police are ready to oblige until Drew begins annoying them with facts, such as the bullet he dug out from the wall was a .38 caliber, whereas all the prop guns were .45 caliber. As a matter of routine, the police decide to arrest the leading lady and then find evidence to fit her. There are other suspects though. A gaffer (electrician) had been demoted by the deceased, and the studio manager's wife had been having an affair with Brent.

Drew gathers clues because the police certainly aren't doing the job. The final scene at the movie studio still has to be filmed. In lieu of a J'accuse! meeting, the play's the thing that will catch the conscience of the king. There is a climactic gun battle across the stage set, and the victim is revealed to be someone out of the blue.

The ending is a cheat but the movie as a whole was quite good. It has witty dialogue and good humour, and holds up well despite eight decades of time. My copy is in the Mill Creek DVD pack of 50 Mystery Classics.

"The Super-Colossal Affair", written by Stanford Sherman, is a 1966 episode of the television series THE MAN FROM U.N.C.L.E., about which I wrote a general overview in this zine in issues #361 to 364. It appeared in the third season of the series, during which the original drama version was replaced with comedic stories, something that began the decline and fall of the show.

The episode at hand is about Frank Cariago, a mobster under pressure from his Uncle Giuliano back in Sicily to take out competitors in Las Vegas for the family. Cariago has a gorgeous girlfriend, Ginger Laveer, who wants to be in the movies in the worst way, which is how she acts.

He solves both problems when he learns that movie director Sheldon Veblen has gone broke in the middle of filming his epic SODOM AND GOMORRAH, about the destruction of Las Vegas by an atomic bomb. He buys into the movie on condition that Laveer gets to act. The final scene, in which a bomber drops the bomb on the city, is set to go with a dummy bomb, which Cariago intends to replace with a real atomic bomb.

UNCLE has sent Napoleon Solo and Ilya Kuryakin to spy on Cariago. They are discovered but because Cariago fears Uncle Giuliano and thinks they are working for him, he treats them like royalty at first. Until, that is, he learns from his uncle that he never sent them.

From there, the plot is fairly predictable. Gunplay, fistfights, and over-elaborate deaths planned for Solo and Kuryakin that don't work out. Veblen is filming an extended fistfight in the bedroom of the fair maiden played by Laveer when the UNCLE agents and the mobsters erupt into the stage set and turn it into a real fight.

Everyone assumes they are part of the act, and the fighting demolishes the set while Laveer sits in the bed going eek! Veblen directs the actors, spies, and mobsters without realizing what is happening.

The two sides, good and evil, sort themselves out in Act 4, with Solo and Kuryakin chasing the bomber down the runway in a car while Laveer drives, then climbing on board just as it lifts off to drop the bomb. Another fight to the finish on board the airplane.

The bomb is released while Kuryakin is straddling it. He rides it down in an obvious homage to Major Kong in the movie DR STRANGELOVE. En route,

he manages to defuse the bomb before opening his parachute. It didn't matter, because Uncle Giuliano, not being able to find an atomic bomb, filled it with 10 tonnes of dimethyl chloryl flouride to make it the biggest stink bomb in history.

The comedy season of TMFU, as Season 3 is now known, ruined the series. If farce is attempted in what was originally a serious spy series, the audience will walk away. The individual episodes such as this one were mildly amusing in their own right but not in keeping with the original premise.

LAST WRITES (2003) by Laura Levine is a cozy mystery about a sitcom writer named Jaine Austen who works for the television series MUFFY 'N ME. The show's handsome leading man Quinn Kirkland is a womanizer of the worst kind. When he nibbles a poisoned doughnut, no one is particularly surprised.

The series is produced by low-budget Miracle Studios, who spare every expense. Their other series is about a group of female police officers, titled PMS SQUAD. The studio's slogan is "If It's A Good Picture, It's A Miracle". Studio politics are vicious and make federal politics look like a walk in the park by comparison. Fortunately for Austen, she is too low-level to be worth bothering about.

Austen is on probation with the studio as a guest writer. If they like her material, she has a chance of getting on permanent as a staff writer. The actors are lunatics but Austen is used to that since her parents are just as odd. They did, after all, saddle her with that name.

The plot begins moving when Kirkland is caught *in flagrante delicto* with the teenage starlet who plays Muffy. Bad news travels fast, and soon most of the women at the studio, behind or in front of the camera, are furious, they being the many that he had bedded. Their boyfriends or husbands aren't any happier. It comes as no surprise that Kirkland was taken out by someone who sugared the doughnut he ate with rat poison.

The suspects take their turn on the stage one by one, until the true culprit is exposed. There is no J'accuse! meeting. The real reason for Kirkland's murder turns out to be unconnected with his sexual adventuring. To be fair, that reason was mentioned earlier in the novel, so technically the author was playing fair with the reader. The novel reads well, with many comedic touches along the way.

TRANSIT FANNING IN CALGARY: PART 20

by Dale Speirs

[Parts 1 to 19 appeared in OPUNTIAs #256, 258, 260, 264, 269, 275, 283, 298, 302, 327, 333, 341, 348, 357, 359, 365, 369, 371, and 392.]

Fiction.

I've been downloading quite a few free pdfs from www.gutenberg.org Among them was a book THE INVENTIONS OF THE IDIOT by John Kendrick Bangs, a 1904 collection of short stories set in a boarding house. Each story is told around the breakfast table. The narratives meander but eventually get to a theme. Two of them dealt with public transit.

"A Suggestion For The Cable Cars" deals with the complaint that in those days a gentleman was expected to give up his seat for a lady. As one boarder bitterly complained, on a long ride he was getting up and moving to another seat further back about sixteen times. He would have been better off standing up all the way, but resented the fact that he couldn't sit and relax.

His suggestion was that gentlemen carry a portable seat that snapped over their laps. Ladies could then sit on the seat without causing undue hardship to men. The method would also generate more friendliness between passengers. Today, of course, ladies are treated equally and can find their seats further back, excepting that pregnant and elderly women will be given seats by other passengers.

"The Trans-Atlantic Trolley Company" was a discussion on how to speed up traffic across the ocean, it being agreed that ships are too slow and tunnels are too expensive. The solution suggested was to string overhead power cables, held up by balloons, and tracks likewise. It almost made sense.

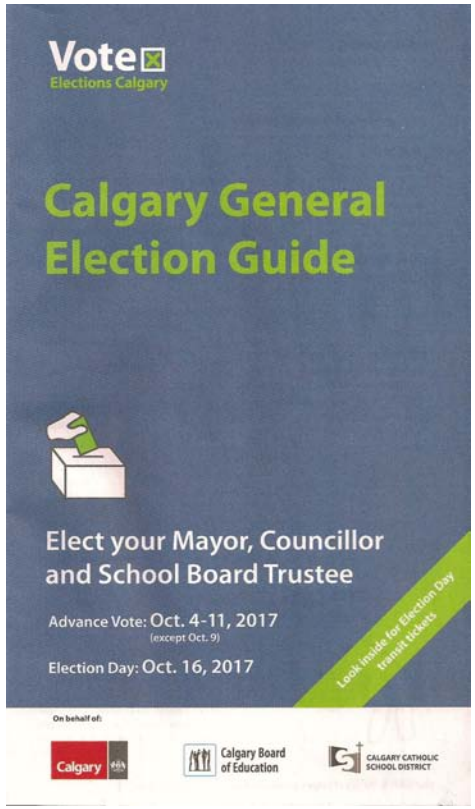
Limited Edition Bus Tickets.

2017 is an election year for Alberta municipalities and school boards. Turnout of voters has historically been low, usually only about half of the electorate bothering to do their duty. The City of Calgary has been trying several different techniques to increase voter turnout. A new one for this cycle is free bus tickets.

I discovered this by chance when I received the usual booklet sent out to all Calgarians, listing the candidates and polling places, and showing the maps of the wards. Bound into the booklet was a pair of bus tickets, not the regular kind but a special colour that could only be used on October 16, the voting day. I buy monthly passes, so they weren't any use to me, but I kept them as souvenirs.

Above: The regular type of bus ticket.

At right: The election booklet into which the special tickets were bound.



SEEN IN THE LITERATURE

Graham, P.W., D.E. Kaplan, and S. Rajendran (2017-09-06) **The born again universe.** arXiv:1709.01999v1 [hep-th] Preprint at www.arxiv.org

Authors' abstract: *We present a class of non-singular, bouncing cosmologies which do not rely on unstable, null energy condition (NEC) violating fluids. These cosmologies evade singularity theorems through the use of vorticity in compact extra dimensions. The vorticity combats the focusing of geodesics during the contracting phase. The compact extra dimensions rely on stable NEC violating sources such as Casimir energy.*

The four dimensional effective theory contains an NEC violating fluid of Kaluza-Klein excitations of the higher dimensional metric. These spacetime metrics could potentially allow dynamical relaxation to solve the cosmological constant problem. These ideas can also be used to support traversable Lorentzian wormholes.

Could the Universe have gone through a bounce? This question is of significant import: a bouncing universe could be past eternal and avoid the Big Bang singularity.

Speirs: Notice the last sentence in the first paragraph. If the Universe does indeed bounce back and forth in size without a Big Bang singularity because of vortices, then it means that short-cutting across the Universe via a wormhole would be possible.

Hirano, S., et al (2017) **Supersonic gas streams enhance the formation of massive black holes in the early universe.** SCIENCE 357:1375-1378

Authors' abstract: *The origin of super-massive black holes in the early universe remains poorly understood. Gravitational collapse of a massive primordial gas cloud is a promising initial process, but theoretical studies have difficulty growing the black hole fast enough. We report numerical simulations of early black hole formation starting from realistic cosmological conditions.*

Supersonic gas motions left over from the Big Bang prevent early gas cloud formation until rapid gas condensation is triggered in a protogalactic halo. A protostar is formed in the dense, turbulent gas cloud, and it grows by sporadic

mass accretion until it acquires 34,000 solar masses. The massive star ends its life with a catastrophic collapse to leave a black hole, a promising seed for the formation of a monstrous black hole.

Tumlinson, J., et al (2017-09-26) **The circumgalactic medium.** arXiv:1709.09180v1 [astro-ph.GA] Preprint at www.arxiv.org

Authors' abstract: *The gas surrounding galaxies outside their disks or ISM and inside their virial radii is known as the "circumgalactic medium" (CGM). In recent years this component of galaxies has assumed an important role in our understanding of galaxy evolution owing to rapid advances in observational access to this diffuse, nearly invisible material. Observations and simulations of this component of galaxies suggest that it is a multiphase medium characterized by rich dynamics and complex ionization states.*

The CGM is a source for a galaxy's star-forming fuel, the venue for galactic feedback and recycling, and perhaps the key regulator of the galactic gas supply. We review our evolving knowledge of the CGM with emphasis on its mass, dynamical state, and co-evolution with galaxies. Observations from all redshifts and from across the electromagnetic spectrum indicate that CGM gas has a key role in galaxy evolution.

Sedaghati, E., et al (2017) **Detection of titanium oxide in the atmosphere of a hot Jupiter.** NATURE 549:238-241

Authors' abstract: *As an exoplanet transits its host star, some of the light from the star is absorbed by the atoms and molecules in the planet's atmosphere, causing the planet to seem bigger; plotting the planet's observed size as a function of the wavelength of the light produces a transmission spectrum. Measuring the tiny variations in the transmission spectrum, together with atmospheric modelling, then gives clues to the properties of the exoplanet's atmosphere.*

Chemical species composed of light elements, such as hydrogen, oxygen, carbon, sodium and potassium, have in this way been detected in the atmospheres of several hot giant exoplanets, but molecules composed of heavier elements have thus far proved elusive. Nonetheless, it has been predicted that metal oxides such as titanium oxide (TiO) and vanadium oxide occur in the observable regions of the very hottest exoplanetary atmospheres, causing thermal inversions on the dayside.

Here we report the detection of TiO in the atmosphere of the hot-Jupiter planet WASP-19b. Our combined spectrum, with its wide spectral coverage, reveals the presence of TiO (to a confidence level of 7.7s), a strongly scattering haze (7.4s) and sodium (3.4s), and confirms the presence of water (7.9s) in the atmosphere.

Raymond, S.N., and A. Izidoro (2017-09-13) **The empty primordial asteroid belt.** arXiv:1709.04242v1 [astro-ph.EP] Preprint at www.arxiv.org

Authors' abstract: *The asteroid belt contains less than a thousandth of Earth's mass and is radially segregated, with S-types* [originating from the terrestrial planet area of the inner Solar System] *dominating the inner belt and C-types* [originating from the Jupiter-Saturn area] *the outer belt. It is generally assumed that the belt formed with far more mass and was later strongly depleted.*

Here we show that the present-day asteroid belt is consistent with having formed empty, without any planetesimals between Mars and Jupiter's present-day orbits. This is consistent with models in which drifting dust is concentrated into an isolated annulus of terrestrial planetesimals.

Gravitational scattering during terrestrial planet formation causes radial spreading, transporting planetesimals from inside 1-1.5 AU [1 AU is the distance between Earth and the Sun] *out to the belt. Several times the total current mass in S-types is implanted, with a preference for the inner main belt. C-types are implanted from the outside, as the giant planets gas accretion destabilizes nearby planetesimals and injects a fraction into the asteroid belt, preferentially in the outer main belt.*

These implantation mechanisms are simple byproducts of terrestrial- and giant planet formation. The asteroid belt may thus represent a repository for planetary leftovers that accreted across the Solar System but not in the belt itself.

Pizzarello, S., and E. Shock (2017) **Carbonaceous chondrite meteorites: The chronicle of a potential evolutionary path between stars and life.** ORIGINS OF LIFE AND EVOLUTION OF BIOSPHERES 47:249-260

Authors' abstract: *The biogenic elements, H, C, N, O, P and S, have a long cosmic history, whose evolution can still be observed in diverse locales of the known universe, from interstellar clouds of gas and dust, to prestellar cores, nebulas, protoplanetary discs, planets and planetesimals.*

The best analytical window into this cosmochemical evolution as it neared Earth has been provided so far by the small bodies of the Solar System, some of which were not significantly altered by the high gravitational pressures and temperatures that accompanied the formation of larger planets and may carry a pristine record of early nebular chemistry. Asteroids have delivered such records, as their fragments reach the Earth frequently and become available for laboratory analyses.

The Carbonaceous Chondrite meteorites (CC) are a group of such fragments with the further distinction of containing abundant organic materials with structures as diverse as kerogen-like macromolecules and simpler compounds with identical counterparts in Earth's biosphere. All have revealed a lineage to cosmochemical synthetic regimes. Several CC show that asteroids underwent aqueous alteration of their minerals or rock metamorphism but may yet yield clues to the reactivity of organic compounds during parent-body processes, on asteroids as well as larger ocean worlds and planets.

Whether the exogenous delivery by meteorites held an advantage in Earth's molecular evolution remains an open question as many others regarding the origins of life are. Nonetheless, the natural samples of meteorites allow exploring the physical and chemical processes that might have led to a selected chemical pool amenable to the onset of life.

Auclair-Desrotour, P., et al (2017-09-27) **Atmospheric tides and their consequences on the rotational dynamics of terrestrial planets.** arXiv:1709.09478v1 [astro-ph.EP] Preprint at www.arxiv.org

Authors' abstract: *Atmospheric tides can have a strong impact on the rotational dynamics of planets. They are of most importance for terrestrial planets located in the habitable zone of their host star, where their competition with solid tides is likely to drive the body towards non-synchronized rotation states of equilibrium, as observed in the case of Venus. Contrary to other planetary layers, the atmosphere is sensitive to both gravitational and thermal forcings, through a complex dynamical coupling involving the effects of Coriolis acceleration and characteristics of the atmospheric structure. These key physics are usually not taken into account in modelings used to compute the evolution of planetary systems, where tides are described with parametrised prescriptions.*

In this work, we present a new ab initio modeling of atmospheric tides adapting the theory of the Earth's atmospheric tides to other terrestrial planets. We derive analytic expressions of the tidal torque, as a function of the tidal frequency and parameters characterizing the internal structure (e.g. the Brunt-Vaisala frequency, the radiative frequency, the pressure heigh scale). We show that stratification plays a key role, the tidal torque being strong in the case of convective atmospheres (i.e. with a neutral stratification) and weak in case of atmosphere convectively stable.

Hin, R.C., et al (2017) **Magnesium isotope evidence that accretional vapour loss shapes planetary compositions.** NATURE 549:511-515

Authors' abstract: *It has long been recognized that Earth and other differentiated planetary bodies are chemically fractionated compared to primitive, chondritic meteorites and, by inference, the primordial disk from which they formed. However, it is not known whether the notable volatile depletions of planetary bodies are a consequence of accretion or inherited from prior nebular fractionation. The isotopic compositions of the main constituents of planetary bodies can contribute to this debate.*

Here we develop an analytical approach that corrects a major cause of measurement inaccuracy inherent in conventional methods, and show that all differentiated bodies have isotopically heavier magnesium compositions than chondritic meteorites. We argue that possible magnesium isotope fractionation during condensation of the solar nebula, core formation and silicate differentiation cannot explain these observations. However, isotopic fractionation between liquid and vapour, followed by vapour escape during accretionary growth of planetesimals, generates appropriate residual compositions.

Our modelling implies that the isotopic compositions of magnesium, silicon and iron, and the relative abundances of the major elements of Earth and other planetary bodies, are a natural consequence of substantial (about 40 per cent by mass) vapour loss from growing planetesimals by this mechanism.

Roberts, J.H., et al (2017) **Effects of basin-forming impacts on the thermal evolution and magnetic field of Mars.** EARTH AND PLANETARY SCIENCE LETTERS 478:192-202

Authors' abstract: *The youngest of the giant impact basins on Mars are either weakly magnetized or completely demagnetized, indicating that a global magnetic field was not present at the time those basins formed. Eight basins are sufficiently large that the impact heating associated with their formation could have penetrated below the core-mantle boundary. Here we investigate the thermal evolution of the martian interior and the fate of the global magnetic field using 3D mantle convection models coupled to a parameterized 1D core thermal evolution model.*

We find that the survival of the impact-induced temperature anomalies in the upper mantle is strongly controlled by the mantle viscosity. Impact heating from subsequent impacts can accumulate in stiffer mantles faster than it can be advected away, resulting in a thermal blanket that insulates an entire hemisphere. The impact heating in the core will halt dynamo activity, at least temporarily.

If the mantle is initially cold, and the core initially superheated, dynamo activity may resume as quickly as a few Myr after each impact. However unless the lower mantle has either a low viscosity or a high thermal conductivity, this restored dynamo will last for only a few hundred Myr after the end of the sequence of impacts. Thus, we find that the longevity of the magnetic field is more strongly controlled by the lower mantle properties and relatively insensitive to the impact-induced temperature anomalies in the upper mantle.

Ortiz, J.L., et al (2017) **The size, shape, density and ring of the dwarf planet Haumea from a stellar occultation.** NATURE 550:219-223

Authors' abstract: *Haumea, one of the four known trans-Neptunian dwarf planets, is a very elongated and rapidly rotating body. In contrast to other dwarf planets, its size, shape, albedo and density are not well constrained. The Centaur Chariklo was the first body other than a giant planet known to have a ring system, and the Centaur Chiron was later found to possess something similar to Chariklo's rings.*

Here we report observations from multiple Earth-based observatories of Haumea passing in front of a distant star (a multi-chord stellar occultation). Secondary events observed around the main body of Haumea are consistent with the presence of a ring with an opacity of 0.5, width of 70 kilometres and radius of about 2,287 kilometres. The ring is coplanar with both Haumea's equator and the orbit of its satellite Hi'iaka. The radius of the ring places it close to the 3:1 mean-motion resonance with Haumea's spin period, that is, Haumea rotates three times on its axis in the time that a ring particle completes one revolution.

The occultation by the main body provides an instantaneous elliptical projected shape with axes of about 1,704 kilometres and 1,138 kilometres. Combined with rotational light curves, the occultation constrains the three-dimensional orientation of Haumea and its triaxial shape, which is inconsistent with a homogeneous body in hydrostatic equilibrium. Haumea's largest axis is at least 2,322 kilometres, larger than previously thought, implying an upper limit for its density of 1,885 kilograms per cubic metre and a geometric albedo of 0.51, both smaller than previous estimates. In addition, this estimate of the density of Haumea is closer to that of Pluto than are previous estimates, in line with expectations. No global nitrogen- or methane-dominated atmosphere was detected.