CONGRÈS ASTRONOMIQUE 1983
1983 ASTRONOMICAL MEETING

C.P. 9396, STE-FOY, QUÉBEC G1V 4B5

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Actes du colloque

tenu à Québec

du 19 au 23 mai 1983

Congrès conjoint de la Société royale d'astronomie du Canada (SRAC), de l'Association des groupes d'astronomes amateurs du Québec (AGAA), et de l'American Association of Variable Stars Observers (AAVSO).

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SRAC - AGAA - AAVSO

QUEBEC, 19 - 23 MAI 1984

COMPTE RENDU DES CONFERENCES / PROCEEDINGS

Encouragé par le succès de l'Assemblée Générale conjointe, le comité organisateur a eu l'idée de préparer un compte rendu écrit des conférences. Tous les participants furent invités à nous envoyer leur article. Mais peut-être sommes-nous arrivés trop tard avec cette proposition! Nous n'avons pas reçu autant de contributions que nous l'espérions. Néanmoins, la qualité des textes reçus en fait un document valable et nous remercions sincèrement ceux qui y ont contribué.

Nous reproduisons d'abord l'horaire et le résumé des communiqués tels que publiés dans le cahier du Congrès, suivis des textes reçus. Ces derniers sont présentés dans le même ordre que l'horaire du Congrès. Un astérisque signifie que la contribution de l'auteur est incluse, alors qu'un double astérisque vous invite à consulter les références supplémentaires mentionnées à la fin.

Plusieurs des textes furent dactylographiés à nouveau. Si des erreurs de transcription s'étaient glissées à notre insu, nous nous en excusons.

Encouraged by the success of the joint General Assembly, the organizing committee got the idea of publishing these proceedings. All participants to the papers sessions have been invited to send us their manuscript. But, perhaps because we have been late with this proposition, we have not received as many contributions as we hoped for. Neverthless, the quality of the received texts make a valuable document and we sincerely thank those who have contributed.

First, we reproduce the schedule of presentation and the abstracts as published in the notebook of the meeting, followed by the papers received. These latter are in the same order as per the agenda of the meeting. One asterisk means that the author contribution is included, and a double asterisk invite you to look at the references mentioned at the end of these proceedings.

Many of the texts have been retyped. We apologize for the errors that we may have been generated throught this process.

1983. 11. 15

Edité par:

Damien Lemay

Membre du Comité organisateur

CONGRES CONJOINT SRAC-AGAA-AAVSO
QUEBEC 19-23 MAI 1983
HORAIRE DES COMMUNIQUES

SAMEDI 21 MAI

	08H30	Mot de bienvenue (M. Jean-Marie Fréchette, prés. de session/chairman)	
*	08h45	M. Denis Bergeron AGAA/Drummondville	Projet de surveillance photographique du ciel
	09h00	Mr. Peter Broughton RASC/Toronto	The First Predicted Return of Comet Halley
	09h15	M. Jean Vallières AGAA/Soc. astron. Montréal	Micro-ordinateur et astronomie
**	9h30	Mr. Clifford Cunningham AAVSO/Kitchener	Analysis of Photometric Data on Asteroids
**	09h45	M. Marc A. Gélinas AGAA/Soc. astron. Montréal	L'effet Schroeter
	10h00	Pause café	
*	10h20	Mrs. C.A. Rutter RASC/Montréal	2001: A Space Odyssey
	~~10h35~~	~~Mr. Peter Ryback~~ ~~RASC/Ottawa~~ Annulée...Cancelled	~~Astronomy in Senior High School~~
*	10h50	Pr. J.E. Kennedy RASC/Saskatoon	On the French Publication "Nouveau traité de la sphère d'après le système de Copernic par demandes et réponses"
*	11h05	M. Mario Lapointe AGAA + SRAC/Québec	Etude densitométrique de films activés
*	11h20	Pr. R.S. Iyengar	Solar Spectral Observations at Sackville, New Brunswick, Canada
	11h45	Photographie de groupe (M. Kedl, photographe)	

DIMANCHE 22 MAI

Président de session (chairman), Dr Jean-René Roy

	08h30	Mr. William V. Webb AAVSO/Akron (Ohio)	Some Constellations Featuring the Sun
	08h45	Mrs. Janet Mattei AAVSO/Littleton (Ma)	The AAVSO - Observing an Data Bank
**	09h00	M. Réal Manseau AGAA/Drummondville	Les Instruments scientifiques du temps passé

DIMANCHE (suite)

	09h15	Mrs. Lee Anne Willson AAVSO/Ames (Iowa)	O-C Magic
	09h30	M. Alain Maury ANSTJ/France	Le contrôle sensitométrique des hypersensibilisations
	09h45	M. Bernard Malenfant Obs. Mt-Mégantic/Québec	2e Festival d'astronomie populaire du Mt-Mégantic
	10h00	Pause café	
*	10h20	Dr. Peter Millman RASC/Ottawa	The Chemistry and Physics of Comet Halley Fragments
	10h35	Mr. Charles S. Morris AAVSO/Harvard (Ma)	The Amateur Astronomer and the IHW (Int. Halley Watch)
	10h50	M. Roger Gagnon AGAA/SAM + SRAC	Taches solaires et planètes: étranges coïncidences
**	11h05	Mr. Jack Newton RASC/Victoria	About a New Observatory and a New 50cm Newtonian Telescope
	11h20	Mr. Dave Schwartz RASC/Kitchener-Waterloo	Establishment and Operation of the Tardis Observatory
*	11h35	M. Sylvain Veilleux AGAA/Drummondville	Reportage photographique du soleil
	11h50	Dîner	

Président de session (Chairman): M. Jean-Marie Fréchette

*	19h30	Mr. D.M. Stokes RASC/Kingston	The Islamic Lunar Calendar
*	19h45	Mrs. Barbara L. Welther Harvard-Smithsonian Center for Astrophysics/Belmont(Ma)	Antonia Maury's Over-corrected Mass-ratio for Beta Lyrae
	20h00	M. Jean-François Lallier AGAA + SRAC/Québec	Le rôle de l'ordinateur dans l'analyse des images astronomiques
*	20h15	Mr. David Levy RASC/Kingston + AAVSO	Sliding to the Stars at Jarnac Observatory
	20h30	Mr. Ernst H. Mayer	Applications of Out-Of-Focus Method
**	20h45	M. Paul Darisse AGAA + SRAC/Québec	Observatoires de Québec

FIN DES COMMUNIQUES

Denis Bergeron, AGAA, Club d'astronomie de Drummondville, Qc

PROJET DE SURVEILLANCE PHOTOGRAPHIQUE DU CIEL OU PROJET PROBLICOM

Ce projet très simple consiste en la comparaison de photos identiques de régions célestes prises en des temps différents. La comparaison de ces photos en utilisant des appareils simples permet de repérer des objets célestes tels étoiles variables, astéroïdes, comètes, etc... On peut également effectuer d'autres types de recherches tels les rotations solaires ou planétaires, les vibrations lunaires, la recherche des satellites planétaires, etc... Dépendant du type de recherche que l'on désire effectuer, le projet PROBLICOM peut nous apporter beaucoup.

J'ai personnellement développé une méthode très pratique qui permet de recueillir une foule de données pratiques comme des objets "Deep Sky", nébuleuses, étoiles doubles sur mes diapos prises avec mes téléobjectifs 135mm et 200mm. Grâce à la comparaison, je recueille d'autres informations supplémentaires comme la position de certains astéroïdes ou le repérage et la localisation de certaines étoiles variables ou autres objets célestes. En inscrivant mes données sur une photo noir et blanc 8 x 10 po. tirée de mes diapos de mes régions célestes, je peux directement utiliser ces photos comme cartes célestes très précises et pratiques. J'ai calculé précisément le champ visuel du chercheur de mon télescope (7 x 50) et sur un acétate j'ai tracé ce champ à l'échelle de mes photos 8 x 10 po.. Ainsi, si je désire repérer un objet céleste quelconque, il me suffit de localiser une étoile brillante le plus près possible de mon chercheur sur ma photo. Je sais qu'en pointant la même étoile j'aurai le même champ que celui apparaissant à l'intérieur de ma "grille" sur acétate. Il suffit de localiser l'objet dans le champ et de pointer le chercheur dessus et le tour est joué.

Peter Broughton, RASC, Centre of Toronto, Ontario

THE FIRST PREDICTED RETURN OF COMET HALLEY

1759 was a year of special historic significance to Québec, plunged as it was in the midst of the Seven Years' War between England and France. It was also a benchmark year in the history of astronomy, marking the first time that a comet's appearance had been successfully predicted.

Newton's theory of Universal Gravitation as applied by Halley to the motion of comets swept away the old Cartesian ideas honoured by the French philosophers. But then, while the English rested on their laurels, the French adopted Newton's theory with great success and made outstanding advances in theorical astronomy in the eighteenth century.

Beginning with Halley's own observations of the comet in 1682 and his predictions of its return, followed by the more sophisticated predictions of the French, this paper traces the events leading up to the first and controversial recovery of Comet Halley in 1759.

Jean Vallières, AGAA, Société d'astronomie de Montréal, Qc

MICRO-ORDINATEUR ET ASTRONOMIE

Une technologie de plus en plus perfectionnée, des logiciels nombreux et diversifiés ainsi que des prix à la baisse permettent au micro-ordinateur de devenir un outil puissant dans de nombreux domaines. L'astronome amateur peut tirer profit du micro-ordinateur dans plusieurs champs d'activités reliés à l'astronomie. En voici quelques exemples:

- Ephémérides astronomiques dynamiques
- Conception de télescopes assistée par ordinateur
- Construction de miroir assistée par ordinateur
- Contrôle automatique des instruments
- Calculs astronomiques divers et simulations
- Banque de renseignements astronomiques
- Secrétariat et administration d'un club
- Jeux vidéo astronomiques et pédagogiques

Tout le monde connaît l'**Observer's Handbook** ou l'**Annuaire astronomique de l'amateur.** On y retrouve des renseignements et des éphémérides valables pour une année complète. Ces éphémérides sont statiques. Cela signifie qu'elles sont calculées pour un temps et un endroit précis.

Les éphémérides obtenues à l'aide d'un micro-ordinateur sont dynamiques: on peut les modifier facilement selon le temps et le lieu d'observation. Sur l'écran cathodique, on peut obtenir en haute résolution une carte du ciel vu de n'importe quel endroit de la Terre et à n'importe quelle date. Cette carte montre non seulement les étoiles mais aussi le Soleil, la Lune et les planètes. Un vrai petit planétarium électronique! Un autre exemple: on peut obtenir une image de Mars telle que vue au télescope à un moment choisi montrant son diamètre apparent, sa phase, son inclinaison ainsi que les détails de surface visibles à cet instant.

Le constructeur de télescope peut utiliser un micro-ordinateur pour voir comment varient les caractéristiques de l'instrument (grossissement, champ de vision, magnitude limite, aberrations, etc.) quand on modifie certains paramètres comme la distance focale ou l'ouverture (Réf. 1). Le micro-ordinateur peut simplifier et accélérer la parabolisation des miroirs en faisant apparaître sur écran un tracé de la forme du miroir obtenu immédiatement après une série de lectures à l'appareil de Foucault.

Le micro-ordinateur peut être utile à l'observation astronomique. Par exemple, pour réussir à photographier une seule étoile filante, il peut être nécessaire de prendre un grand nombre d'expositions photographiques échelonnées sur plusieurs heures. Avec l'ordinateur, l'observateur n'a plus besoin de passer la nuit à côté de son appareil pour prendre ce genre de photos. L'ordinateur s'occupe d'avancer le film, de déclencher l'obturateur, de mesurer le temps de pose et de compter les photos (Réf. 2). L'astrophotographe peut aussi se servir d'un micro-ordinateur pour prévoir ses tempos d'expositions en fonction de l'instrument, de l'objet, du film, etc.

Le principal obstacle à une utilisation plus répandue du micro-ordinateur par l'astronome amateur demeure encore la rareté du logiciel astronomique et l'incompatibilité entre les diverses marques de micro-ordinateurs. On peut toujours écrire soi-même ses programmes pour **son** ordinateur en utilisant des éphémérides astronomiques et des volumes sur les calculs astronomiques (Réf. 3 et 4). Il existe même des manuels contenant des programmes déjà écrits en BASIC pour l'astronomie (Réf. 5). La tâche d'entrer ces programmes au clavier de son ordinateur est cependant toujours longue et ardue.

On peut penser que d'ici peu de temps, une nouvelle activité apparaîtra à l'intérieur des principaux groupes d'astronomes amateurs: soit la construction d'une banque de logiciel astronomique. Cette banque contiendrait sur cassettes et sur disques des programmes d'astronomie pour plusieurs types de micro-ordinateurs. Les personnes intéressées pourraient se procurer ce logiciel ou même participer à la construction de la banque.

Références:

1- **Computing Telescope Parameters with the OSI Superboard II**, R.B. Minton, BYTE, mars 1983, page 450.

2- **VIC Invades Space**, J.M. Franke, MICROCOMPUTING, janvier 1983, page 50

3- **Text Book on Spherical Astronomy**, W.M. Smart, Cambridge University Press, 430 pages.

4- **Explanatory Supplement to the American Ephemeris and Nautical Almanac**, U.S. Government Printing Office, Washington, D.C., 533p.

5- **Celestial BASIC. Astronomy on your Computer**, E.B. Burgess, SYBEX, 1982, 300 pages.

Clifford Cunningham, AAVSO, Dance Hill Observatory, Kitchener, Ontario

ANALYSIS OF PHOTOMETRIC DATA ON ASTEROIDS

Photoelectric photometry of an asteroid can be analysed to yield a great deal of information about it. First, using Fourier harmonic analysis, the rotation period can be derived. If the data spans several days or weeks, the phase coefficient can be calculated, giving a measure of how rapidly it varies in magnitude during an opposition. After determining its absolute magnitude, a simple series of equations permits calculation of the asteroids' albedo and diameter. Data spanning several oppositions can be used to determine the asteroids' pole position. Observations are presented and computer programs are described that calculate all these parameters except the pole position.

Marc A. Gélinas, AGAA et SRAC, Société d'astronomie de Montréal, Qc

L'EFFET SCHROETER

Il s'agit d'un effet peu connu qui a été identifié par l'astronome Schroeter au XVIIIe siècle. Schroeter avait remarqué que la date d'observation de la dichotomie de Vénus et Mercure, avançait lors des élongations Est, et retardait lors des élongations ouest, par rapport à la date théorique.

Ce phénomème s'explique par une perte de luminosité du côté éclairé de la ligne du terminateur.

J'ai demandé aux astronomes amateurs du pays de participer à la vérification de cet effet, lors de l'élongation de Vénus, en juin prochain.

Si l'intérêt des amateurs est éveillé, on pourra étendre le projet aux élongations subséquentes et à Mercure. Avec un nombre suffisant de données, on pourrait juger de l'effet Schroeter en relation avec diverses combinaisons d'instruments et de grossissement.

En s'adressant autant au débutant qu'à l'amateur chevronné, ce projet ouvre des perspectives nombreuses.

Ms. Carol A. Rutter, RASC, Montreal Centre, Qc

2001: A SPACE ODYSSEY

In my current ongoing research, few science fiction films allude to even a fraction of the accuracy evident in **2001: Space Odyssey.** Amateur and professional astronomers perhaps would allow blatant lapses in accuracy if the fiction were more exciting than the truth. For exemple, points of view from other celestial locales often have backgrounds of pink skies, multiple suns, or so much night time light that there is never darkness. One only need invest $35 for an introductory astronomy book to find high quality reproductions of photos from earth telescopes, probes photos and paintings for films ideas. Well-established cinema techniques like animation and painted backdrops may be used to convey these spectacular visuals.

Cinematic errors in ideas are even more annoying, since no much literature is available to those with no specialized knowledge. For exemple, with a minimum of thought and research, one is forced to raise the following questions regarding filmed representations of extraterrestrials: why do aliens always visit earth? Why don't we visit them? Why are aliens bilaterally symmetrical, with feet and eyes? Why do alien space ship mostly land at night with lights? Don't they ever land during the day? Do aliens also have reduced nignt vision like humans? Until recently, why have aliens mostly been hostile, ominous and threatening? In a few weeks, how could E.T. learn English? Or worse, E.T. has a mouth, eats, but doesn't like potato salad!

Plural theories regarding far away celestial phenomena and extraterrestrials combine a number of these speculations with talent and artistic license and the resulting film, more or less, must be interesting, accurate, provocative and potentially educational. Stanley Kubrick, director of **2001**, seemed to recognize this as a long time fan of Arthur C. Clarke. Book after book, Clarke's novels demonstrate this thesis.

Stimulated by Clarke's **The Sentinel**, Kubrick contacted Clarke for collaboration on **2001.** Additionally, Kubrick independantly researched ideas like human hibernation, man-machine interaction in outer space, spacesuit design, space food, zero gravity simulation, computer design, jargon and outer space application and nuclear propulsion, to name a few.

Many aspects of the finished film infer this research. Some examples include The Daws of Man (apes) sequence, the monolith, outer space scale and perspective, vehicule shapes, design concepts of lunar spaceport, real zero gravity vs simulated earth gravity in spaceport and vehicles. Respectively, they refer to Darwinian evolution, radio astronomy, NASA models and astronaut research and training - esp. gravity simulation tanks.

Additionally, a brief run-through of film techniques used in **2001** will demonstrate that Kubrick both used old techniques and special effects and invented new ones, now staples of science fiction films.

To conclude, 15 years have passed since the 1968 release of **2001.** Yet, film-goers are still besieged by uninspired scripts and glaring inaccuracies exemplified in **E.T.**, **Stars Wars**, **The Empire Strikes Back** and **Star Trek.** Record numbers attended these films which promote misleading information and false conclusions. However, some interstellar possibilities were intelligently applied in **Slaughterhouse Five** and **Hitchhikers Guide to the Galaxy.**

Peter R. Ryback, RASC, Ottawa Centre and Timiskaming Astronomical Society, Cobalt-Haileybury High School, Ontario

ASTRONOMY IN SENIOR HIGH SCHOOL

A new course in Astronomy is now being offered as an option to Grade 12 students at Cobalt-Haileybury High School in the Timiskaming District of Ontario. Approved by the Ministry of Education on an experimental basis, the course was taught successfully during the semester ending January, 1983. Various details of the course's development and content will be discussed.

J.E. Kennedy, RASC, Saskatoon Centre, dept. of Physics, Univ. Saskatoon, **Saskatchewan**

In 1980, a survey was carried out of the old books in astronomy held by university and other scientific libraries across Canada. Among the items discovered in this survey was a pamphlet held in CANADIANA collection at Université de Montréal, with the brief title **Nouveau traité abrégé de la sphère d'après le système de Copernic par demandes et par réponses.** (A second copy was located later in the Edith and Lorne Pierce Collection of CANADIANA at Queen's University, Kingston, Ontario).

This pamphlet was published in Montréal in 1829 and was intended for use in the schools of Lower Canada, now the province of Québec. The title page contains the words: "Nouvelle Edition"; as yet, an earlier edition of this work has not been located. As well, the purpose of the publication was shown on the title page as: "A l'usage des Ecoles de cette Province"; no information has been found to indicate whether this early work on astronomy was adopted and used in the schools.

A translation of this document has been carried out; the coverage of astronomy in the pamphlet will be summarized as part of the presentation of this paper.

Mario Lapointe, SRAC et AGAA, Centre de Québec, Qc

ETUDE DENSITOMETRIQUE DE FILMS ACTIVES

Depuis plusieurs années, je m'intéresse à l'activation des films. Je vous propose cette année une étude sur la densité des films exposés en laboratoire après activation à la formine. Cette étude vise particulièrement à identifier les paramètres les plus importants dans le processus d'activation. Nous nous attarderons à la durée d'activation, la température de la chambre, la pression y régnant ainsi que sur la durée du vide précédent le traitement.

La connaissance du paramètre le plus influent permettra éventuellement d'optimiser le processus d'activation afin de diminuer la durée de ce dernier. La durée d'activation peut atteindre dans certains cas plus de 24 heures. Le film étudié fut le 2415 de la compagnie Kodak.

R.S. Iyengar, RASC(unattached), Mount Allison University, dept. Physics, Math & Astronomy, New Brunswick

SOLAR SPECTRAL OBSERVATIONS AT SACKVILLE, NEW BRUNSWICK, CANADA

Recent observations of solar/atmospheric spectra in the visible region by photographic techniques will be presented. Some photometric observations relating to alkali elements in the terrestrial atmosphere will also be illustrated.

William V. Webb, AAVSO, Akron, Ohio

SOME CONSTELLATIONS FEATURING THE SUN

Janet Mattei, AAVSO, Massachusetts

THE AAVSO - OBSERVING AND DATA BANK

Réal Manseau, AGAA, Club d'astronomie de Drummondville, Qc

LES INSTRUMENTS SCIENTIFIQUES DU TEMPS PASSE

L'étude et la fabrication d'instruments scientifiques de toutes sortes s'avèrent de bons moyens de comprendre et de visualiser les mouvements astronomiques complexes décrits par la théorie de la mécanique céleste.

Une façon pratique d'observation et de repérage est de mesurer la hauteur d'un astre en rapport avec la ligne d'horizon et d'évaluer son déplacement par rapport aux coordonnées azimutales; cette méthode est le principe même du théodolithe, on peut voir le fonctionnement de cet appareil sur des diapositives couvrant le sujet. Ce théodolite a été construit en 1979.

L'observation régulière du déplacement du soleil sur la voûte céleste nous conduit à la compréhension des principes de construction du cadran solaire. Le cadran solaire rend tangible le mouvement diurne de la terre en observant le déplacement de l'ombre qui avance entre les graduations des heures. Le cadran solaire permet aussi de remarquer la variation en hauteur du soleil par rapport à l'équateur céleste au fil des saisons. On peut remarquer aussi un décalage entre l'heure solaire vraie (le temps solaire) et l'heure moyenne (des montres). Cette différence est corrigée par l'application du calcul de l'équation du temps. Sur diapositives. Cadran solaire équatorial polaire construit en 1977.

Pour pousser plus loin ma connaissance en mécanique céleste, j'ai étudié les principes de la sphère armillaire de Ptolémée. Cet ensemble de cercles représente plusieurs coordonnées célestes soit: l'équateur, la bande du Zodiaque, l'écliptique, les tropiques du Cancer et du Capricorne, les pôles célestes nord et sud, les cercles des pôles de l'écliptique, la ligne du méridien, les colures qui séparent les quatres saisons et la ligne d'horizon du lieu. J'ai construit cette sphère de Ptolémée en 1979. (Voir diapositives).

Pour poursuivre ma recherche et mieux comprendre le principe de la sphère armillaire, j'ai étudié le système de Ptolémée qui place la terre au centre du monde à cette époque et celui de Copernic qui est arrivé à concevoir un système héliocentrique. J'ai mis en application ces deux théories et j'ai construit une sphère qui peut se convertir et représenter ces deux grands principes de conceptions du monde. La terminologie de chacun des cercles est la même que décrite précédemment. Pour ce qui est de la description de détails il vaut mieux présenter l'appareil en diapositives commentées. Cette sphère que j'ai baptisée "Sphère Armillaire Ptolémée - Copernic" fut construite en 1982.

L'étude des systèmes de coordonnées célestes et terrestres a éveillé mon attention sur les mouvements complexes de la lune dans sa trajectoire mensuelle. Après maintes réflexions et recherches, j'ai décidé de me construire un appareil qui représenterait les mouvements de rotation diurne de la terre, l'inclinaison de 23.4 degré par rapport à l'écliptique, la rotation et la translation "simulée" de la lune et du soleil tournant autour de la terre, sur l'arrière plan des constellations du Zodiaque. Pour compléter le tout, j'y ai inclus une ligne d'horizon terrestre ajustable qui permet de visualiser la voûte céleste de tous les horizons locaux du globe. Lors d'une démonstration on peut voir le soleil et la lune se croiser, se surélever, s'abaisser et rarement s'aligner afin de produire une éclipse de soleil ou de lune. Cet appareil est appelé "Tellurium - Lunarium", et il a été réalisé en 1983.

Lee Ann Willson, AAVSO, Iowa State University, Physics Department, Iowa

O-C MAGIC

The period or periods of variable stars can reveal important information about their internal structure and the nature of their variation. Many methods exist for determining the period(s); however most of these are heavily mathematical, and often they include assumptions about the nature of the variability which may not be justified. For example, most methods assume that the period(s) are not changing with time. A simple, graphical method which is often very effective in showing the presence of multiple periods or of changes in the variability is the O-C diagram. This diagram is simply constructed by plotting the observed (O) minus the calculated (C) time of maximum (or minimum or mean ...) light, where a trial value of the period is used to obtain the calculated times of maximum light. I will show examples of O-C diagrams for interesting cases, and indicate how period changes and other phenomena generally affect the O-C.

Alain Maury, Association nationale des sciences techniques jeunesse, France

LE CONTROLE SENSITOMETRIQUE DES HYPERSENSIBILISATIONS

De plus en plus d'amateurs pratiquent aujourd'hui les techniques d'hypersensibilisations notamment sur film 2415. Peu de références sérieuses existent sur ce sujet. Après avoir passé en revue les techniques et le matériel existant, on abordera des notions de sensitométrie indispensables pour mener correctement ce genre de traitement: courbes caractéristiques de films, sensibilité des films, rapport signal/bruit, rendement quantique équivalent. On traitera ensuite du contrôle précis de l'action des hypersensibilisations.

La deuxième partie de cet exposé abordera la mise en oeuvre de ces techniques au niveau de l'amateur: construction d'un sensitomètre, d'un densitomètre, logiciels de contrôle des hypersensibilisations sur micro-ordinateurs, présentation de quelques photographies d'amateurs français.

La troisième partie sera une présentation des essais d'amateurs français sur le thème des traitements numériques d'images: le matériel utilisé, les logiciels de base, les extensions futures. La philosophie du système: mettre en oeuvre un système de photométrie bidimensionelle avant 1986: Halley.

Bernard Malenfant, Observatoire du Mont-Mégantic, Qc

LE 2 e FESTIVAL D'ASTRONOMIE POPULAIRE DU MONT-MEGANTIC

Je parlerai en premier lieu de la place qui revient à l'astronomie populaire au Québec. Après avoir dressé une esquisse du Festival de l'an passé, je passerai en revue quelques commentaires des participants de l'année dernière. Je présenterai ensuite les activités du 2e Festival ainsi que des informations sur les inscriptions et les adresses de nos bureaux de renseignements. Finalement, une invitation sera lancée à tous les astronomes amateurs, non seulement à participer mais aussi à s'impliquer directement pour une meilleure réalisation du 2e Festival d'astronomie populaire du Mont-Mégantic.

Peter M. Millman, RASC and AAVSO, Ottawa Centre, National Research Council Canada, Herzberg Institute of Astrophysics, Ottawa

THE CHEMISTRY AND PHYSICS OF COMET HALLEY FRAGMENTS

The meteor showers, the **Eta Aquarids** in May and the **Orionids** in October, contain fragmented material from Comet Halley. Various chemical and physical parameters for groups of meteors belonging to these two showers have been determined from the analysis of both direct photographs and spectrograms. These parameters include chemical compositions, bulk densities, fragmentations indices and ablation coefficients. In round figures the mass range of the meteroids studied extends from 0,01 to 100 grams.

The chemical and physical characteristics of the Halley Comet meteroids are compared with those from other meteor showers. The Giacobinid meteorids are exceptional in their low density and high fragmentation index, while the Geminid meteorids, in contrast, are of high density with a much lower tendency to fragment. The Halley Comet Meteroids are in between those two extremes, but are somewhat closer to the low-density, high-fragmentation particles.

Charles S. Morris, AAVSO, Prospect Hill Observatory, Harvard, Massachusetts

THE AMATEUR ASTRONOMER AND THE IHW

The current apparition of Halley's comet has generated considerable interest in the astronomical community. This has been highlighted by the formation of the International Halley Watch (IHW) which coordinate ground-based observational activities. The IHW is divised into "Nets" corresponding to different observational disciplines. The focus of this talk will be the Amateur Net.

The Amateur Net is headed by Steve Edberg, Jet Propultion Laboratory. Amateur contributions will include visual, photographic and photoelectric observations of the comet. The amateur observations are important because the amateurs will be observing the comet using the same methods that the professionals used in 1910.

In this talk, an overview of the Amateur Net will be given. The organization and observational programs of the Net will be presented.

Roger Gagnon, AGAA et SRAC, Société d'astronomie de Montréal, Qc

TACHES SOLAIRES ET PLANETES: ETRANGES COINCIDENCES

Il y a maintenant près de trois siècles qu'on observe les taches solaires. Ceci est un travail fait à l'aide d'un micro-ordinateur ZX-81 et des statistiques de l'activité solaire depuis 1900.

L'analyse de Fourier permet de retrouver la période du cycle solaire, qui est de 11,1 ans, ainsi que d'autres périodes superposées à ce cycle. Ces autres périodes sont presque toutes reliées aux révolutions synodiques des grosses planètes, les unes avec les autres, ce qui semble indiquer que ces planètes ont une influence non négligeable sur le cycle solaire. Seules les grosses planètes semblent avoir de l'effet; de plus, le résultat est différent selon les cycles solaires pairs ou impairs, ce qui suggère fortement une influence magnétique puisque la polarité magnétique du soleil s'inverse à chaque cycle.

Jack Newton, RASC, Victoria Centre, British Columbia

This paper will deal with my construction of a new 3,7 m observatory and a 50 cm newtonian telescope designed for astrophotography. The talk will deal with the construction phases and my new designes incorporated into the telescope and observatory along with a number of photographs taken with the new instrument.

Dave Schwartz and Murray Kaitting, RASC, Kitchener-Waterloo Centre, Ontario.

ESTABLISHMENT AND OPERATION OF THE TARDIS OBSERVATORY

The Tardis photoelectric observatory was built during the summer of 1982 in the city of Waterloo, Ontario. A city location was chosen for 3 reasons: 1) convenience - ease of construction, reduced vandalism and improved home life, 2) access to on-site computer facilities and, 3) the fact that dark skies are not needed since background is cancelled out during data reduction.

Construction is standard silo block with a modified 10' silo top as a dome. A concrete pier support a 14 1/2" Cassegrain telescope on an Astroworks fork mount. The photometer is an EMI Starlight-1 photon counter interfaced to an Apple II+ microcomputer.

At present, computer programs have been written in the Basic language for data acquisition, reduction and analysis on both stars and asteroids. Plans are underways to re-write these programs in the Forth programming language in order to make full use of the facilities. Current computer hardwire includes two disk drives, printer, real time clock, photometer interface and remote keyboard/monitor.

Current observations include asteroids, RS CVn stars and nearby stars in need of photometry.

Sylvain Veilleux, Club d'astronomie de Drummondville, Québec.

REPORTAGE PHOTOGRAPHIQUE DU CIEL

La conférence portera sur une série de photographies du ciel prises au cours du mois d'août 1981. En première partie, je parlerai des détails pertinents à la prise de ces photos: instruments et filtres utilisés, film employé, etc. De plus, je discuterai brièvement du travail en chambre noire nécessaire à la réalisation d'un tel projet. La deuxième partie sera consacrée à l'analyse des résultats. Il sera entre autres question de la classification de Zürich des groupes de taches solaires. Je mentionnerai aussi comment elle me permet de retracer efficacement l'évolution des 20 groupes de taches étudiés au cours de ce reportage. Je dirai ensuite quelques mots sur des phénomènes solaires tels que l'effet de perspective, l'effet Wilson et la granulation photosphérique. Enfin, je terminerai en discutant du célèbre cycle solaire. Des diapositives viendront s'insérer à titre d'exemples explicatifs.

D.M. Stokes, RASC, Kingston Centre, Ontario.

THE ISLAMIC LUNAR CALENDAR

The theorical basis for a lunar calendar is examined and the current Islamic lunar calendar is reviewed. It is found that because of the irregular but rythmic motions of the Moon the Islamic calendar cannot be prepared in advance. This might be feasible if the age of the new Moon at earliest visibility could be established by observation, but this has not yet been done in the last 1400 years. It is also shown that the correct date for the beginning of the Islamic era (1 Ali Muharram 1) is, most appropriately, Friday, 16 July, 622.

Barbara L. Welther, Harvard-Smithsonian Center for Astrophysics, Cambridge, Massachusetts

ANTONIA MAURY'S OVER-CORRECTED MASS-RATIO FOR BETA LYRAE

In the course of classifying stellar spectra photographed at Harvard College Observatory in the 1890s, Antonia Maury observed fascinating complex changes in the spectrograms of Beta Lyrae. She monitored these changes in the 1920s and published her analysis and interpretation of them in 1933. Because her solution for the mass-ratio differed greatly not only from other previously-published results but also from the prediction of Eddington's mass-luminosity relation, Otto Struve criticized it immediately. This paper will investigate the erroneous assumption Miss Maury made in deriving her solution and the justification Struve had in questioning it.

Jean-François Lallier, SRAC et AGAA, Centre de Québec, Québec.

LE ROLE DE L'ORDINATEUR DANS L'ANALYSE DES IMAGES ASTRONOMIQUES

Depuis la décennie 1970, le traitement numérique des images connaît un essor considérable. Plus spécifiquement, l'avènement des micro-densitomètres panoramiques et des détecteurs bi-dimensionnels à état solide, tels que les CCD et les caméras à balayage continu, ont permis une analyse plus précise des phénomènes physiques dans l'univers: photométrie stellaire et

galactique, étude des profils de luminosité des galaxies en amas, étude des champs de vitesses dans les nébuleuses, etc.

Dans ce contexte, l'objectif de la conférence consiste à présenter quelques-unes des plus récentes méthodes d'analyse des images astronomiques, élaborées sur ordinateur, avec quelques exemples d'applications dans le domaine de la photométrie stellaire et galactique: repérage et classification des étoiles et des galaxies dans une image numérisée, calcul des magnitudes stellaires et galactiques, établissement des profils de luminosité des galaxies en amas, etc.

David H. Levy, RASC and AAVSO, Kingston Centre, Arizona

SLIDING TO THE STARS AT JARNAC OBSERVATORY

My first observing session within the walls of a sliding roof observatory was a real eye-opener. In an instant, I was protected from wind, from unwanted animals, and from having to run inside to look for star charts. I learned that an inexpensive, easily built sliding roof observatory could provide comfort and convenience that results in observations of increased accuracy and quality.

This paper considers the observatory buildings that now await the sunset at Jarnac Observatory. It will trace the proceedure by which I designed and built the main station, and it will encourage other amateurs to avoid some of the construction errors I made.

Finally, the paper will explore the benefits a small observatory building offers in variable star observing and in other disciplines.

Ernst H. Mayer, AAVSO, Ohio

APPLICATIONS OF OUT-OF-FOCUS METHOD IN AMATEUR ASTRONOMY

Out-of-focus (OF) images of stars, usually considered undesirable by astronomers, can be used with success in a variety of applications where sharp images would reveal nothing particular in term of informations.

These applications include
1. Alignment of optical systems
2. Judgment of turbulence inside a reflecting telescope
3. Detection of obstructions in the optical path
4. Observing variable stars

This paper constitutes a conscious attempt to use the OF - method to improve visual observations.

Paul Darisse, SRAC ET AGAA, Centre de Québec, Québec

OBSERVATOIRES DE QUEBEC

L'astronome qui arrive en visiteur à Québec se demande où se trouve l'observatoire. Un almanach bien connu lui indique la position d'un observatoire optique, en latitude 46 47' 59.2" et en longitude 71 13.2'. Rendu à la position donnée, l'astronome ne voit pas trace d'un observatoire, et il constate qu'il ne peut y en avoir. Où donc était cet observatoire?

D'autre part, le Bulletin des Recherches Historiques de 1923 affirme que l'observatoire de la Citadelle fut démoli en 1874. Autre désappointement! Par ailleurs, le même Bulletin, dans un article publié en 1936, nous parle d'un observatoire érigé sur la citadelle en 1854 et 1855, tandis qu'un article de 1918 dans "The Journal of the R.A.S.C." nous affirme qu'un lieutenant nommé Ashe a assumé la tâche de directeur de l'Observatoire de Québec en 1850. Quelle est la date exacte?

Et les autres observatoires d'amateurs ou d'enseignement, est-ce qu'il y en a?

L'auteur tentera d'apporter à ces questions des réponses valables.

PROJET DE SURVEILLANCE PHOTOGRAPHIQUE DU CIEL
(PROJET PROBLICOM)

Denis Bergeron

Lorsque nous prenons une photographie du ciel et que nous l'examinons, nous sommes émerveillés de voir des milliers d'étoiles apparaissant sur cette simple feuille de papier. Si nous la comparons à un atlas céleste, nous pouvons y déceler certains objets assez brillants. Notre émerveillement semble croître à mesure que l'on découvre de plus en plus de détails sur notre photo.

Cette croissance de l'émerveillement peut encore s'accroître si on utilise un moyen qui permet de découvrir d'autres types d'objets célestes, souvent invisibles même si on utilise un atlas précis. Ces objets peuvent être des étoiles variables, des nova, des comètes, des astéroïdes ou même des planètes faibles. On peut les retrouver facilement en comparant nos régions du ciel photographiées à l'aide d'un comparateur.

Ainsi, en photographiant des régions identiques du ciel à des dates différentes et en comparant nos photos, nous pouvons repérer certains types d'objets célestes invisibles autrement, ce qui donne à nos photos une véritable mine d'information. De plus, notre photo peut devenir une des plus précise carte du ciel que vous pourrez utiliser avec vos instruments.

Ce moyen de repérage a été appelé "projet problicom" par l'américain Ben Mayer. C'est un projet très facile d'exécution et qui promet de vous révéler d'intéressantes surprises.

C'est le projet idéal à tout amateur qui désire poursuivre des recherches utiles en astronomie.

Comment exécuter le projet?

Le projet consiste à prendre une série de photos (diapos) du ciel avec une caméra et lentille ordinaire et lors d'une autre occasion (1 jour, 1 semaine, 1 mois, etc. plus tard), il suffira de reprendre la même région en utilisant les mêmes données techniques tels même film, même lentille, même étoile guide, etc. Et, par la suite, de comparer les diapos en utilisant un comparateur problicom ou un stéréoscope-comparateur.

Équipements nécessaires:

- Appareil photo équipé d'un viseur "reflex" et pouvant accueillir différents types de lentilles tels les télé-objectifs. L'appareil devra contenir la pose "B" exposition continue.

- Table sidérale ou téléscope équipé d'une monture équatoriale, d'une vis de guidage en ascension droite manuelle ou motorisée et d'un téléscope guide avec réticule illuminé. Il est inutile d'avoir un instrument dispendieux, une simple monture de type "poncet" fait très bien l'affaire.

  La table sidérale devra contenir un adapteur fixe de caméra monté de préférence sur le télescope guide. Il est primordial que la caméra soit attachée au même endroit sur le support pour éviter les problèmes de cadrage lors de la comparaison.

Bon atlas céleste tels "Atlas of the heavens ou L'atlas de l'AAVSO".

Comparateur problicom:

Il s'agit de deux projecteurs superposés l'un au-dessus de l'autre sur des plates-formes ajustables que l'on peut facilement ajuster pour superposer deux diapositives d'une même région du ciel sur l'écran. On fait tourner un demi-disque occulteur entraîné par un moteur variable devant chacune des lentilles des projecteurs et en observant l'écran, il est possible de repérer nos objets célestes selon qu'ils présentent l'un des trois effets suivants:

Va et vient:

Si la période de temps entre les 2 photos est assez courte (1 jour ou 2), il est possible que certains astres errants tels les astéroïdes, les comètes, les planètes, etc. changent de position d'une photo à l'autre. L'effet sera semblable à un va et vient.

Pulsation:

Si la différence de temps est autour de quelques semaines, certaines étoiles peuvent avoir changé de brillance telles les étoiles variables. L'effet caractéristique sera une pulsation de l'étoile.

Flash:

Si la différence de temps est de plusieurs mois, certains astres errants peuvent apparaître sur une de vos diapos alors qu'ils n'y sont pas sur l'autre. De même d'autres types d'objets célestes telles les variables à longue période peuvent présenter un effet de flash sur l'écran.

- Cartes des étoiles variables ou des éphémérides,des astéroïdes, comètes, etc. Également, une personne ressource compétente serait d'un grand secours s'il y avait "découverte".

Méthode à suivre:

La méthode est bien simple, il suffit d'identifier dans un atlas la région du ciel à photographier, d'identifier nos étoiles guides et de toujours utiliser ces étoiles guides.

La table sidérale devra être pointée précisément sur le Pôle-Nord céleste pour que nous puissions guider avec précision. La caméra devra être montée en parrallèle sur le télescope guide (Piggyback) de façon à ce qu'une même étoile soit centrée dans le chercheur, le réticule du télescope guide et le viseur de notre caméra. Cela facilitera de beaucoup le pointage de nos étoiles guides.

Il ne nous restera qu'à photographier nos régions du ciel en prenant soin de bien guider et de toujours prendre 2 poses pour éviter les doutes lors des comparaisons. Nous avons avantage d'exposer au maximum nos photos pour enregistrer le plus de détails possibles.

Une fois nos photos prises, il suffira de repéter la même opération une autre fois pour que nous ayons une autre série que nous allons comparer à la première.

Avant de procéder à cette étape, je conseille de bien identifier nos photos (diapos) et de bien prendre en note nos données techniques.

Pour ceux qui peuvent le faire, je conseille de tirer un agrandissement 8 X 10" de chaque région du ciel afin d'inscrire la position précise de nos objets repérés.

Lors de la comparaison, il faut que l'écran soit assez loin du comparateur pour éviter la parrallaxe entre les 2 lentilles des projecteurs. Une fois les diapos bien superposées et le demi-disque en marche, il suffit de s'approcher de l'écran et de balayer lentement l'image pour tenter de repérer tout objet possible.

Si nous croyons avoir repéré un objet particulier, il est bon de noter la position précise sur la photo et d'utiliser les secondes photos de chaque série pour bien confirmer s'il s'agit réellement d'un objet céleste et non d'une poussière ou d'un défaut du film.

Par la suite, il suffira de vérifier avec un atlas décrivant le type d'objet repéré et s'il s'agit d'un objet réel de l'inscrire clairement sur la photo. Vous pouvez vous attendre à "découvrir" ou plutôt à "repérer" une foule d'objets célestes.

Conclusion:

Grâce à cette méthode, nous pouvons augmenter la valeur de nos photos en y ajoutant nos objets identifiés. Si vous êtes intéressés à les observer, il suffira de prendre simplement votre photo et d'utiliser votre télescope en vous fiant sur les étoiles repérées de votre photo. Vous aurez ainsi, l'une des meilleures cartes du ciel et vous verrez qu'il est beaucoup plus intéressant et motivant de se servir de nos propres photos.

En terminant, j'invite tous ceux s'intéressant à ce projet à m'écrire, je me ferai un plaisir de leur envoyer mon document complet sur le projet problicom avec plans, schémas, photos, etc. Pour ma part, je suis très actif dans ce projet et j'espère que dans un avenir rapproché, il y aura d'autres amateurs qui suivront mes traces.

Bonnes astrophotos!

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THE UNIVERSE ACCORDING TO STANLEY KUBRICK

By CAROL A. RUTTER

The history and authorship of 2001: A Space Odyssey is more often misunderstood and misrepresented in discussions than it is faithful to the true order of events. According to The Making of Kubrick's 2001, edited by Jerome Agel, interviews with both Arthur C. Clarke and film director Stanley Kubrick plus the closing credits of the film unquestionably indicate that the film script and the film's release predate the book's publication. Originally, the credits for the film script were to read "by Stanley Kubrick and Arthur C. Clarke", while the book would credit "Arthur C. Clarke and Stanley Kubrick". For reasons not explained by Agel, Kubrick's name was dropped from the book and the misunderstanding was born. In any case Kubrick conceived 2001 before he contacted Clarke and all subsequent scientific research conforms with Kubrick's drive for accuracy. Before the film's release, Kubrick said: "Everything possible will be done (in 2001) to make each scene completely authentic and to make it conform to what is known to physicists and astronomers." In the 2001 authorship debate, few would suggest that Kubrick singlehandedly created the scientifically accurate sequences. More realistically, Kubrick's attitude towards science strongly influences the film's tone, content and futuristic implications and his contribution is most often underestimated or dismissed by Clarke fans.

In his role as co-author, Clarke's inferred potential was fully realized. Not only did Clarke realize his maximum writing potential, but he also was the best choice at that time for the necessary refinements in transcribing raw scientific data to film. Because of the imagination and feasibility of Clarke's scenarios, his books are appreciated by scientists. Because of Clarke's background in science, the less informed reader (viewer) may respond to the fantastic nature of his plots, yet Clarke quietly promotes science because the reader seeking entertainment may inferentially learn some aspects of science.

For some time, a sizeable market exists for science fiction, however most books mutely demote science and promote anti-intellectualism for the sake of shock and sensation, as if accuracy and a compelling plot are contradictory terms. Clarke and a handful of other writers prove that science can be communicated through literature with fiction engaging enough that profits may be realized.

More recently, the film industry has been spending and making megabucks on what they call "science fiction". Since the mid-seventies release of Star Wars, Hollywood has been clearing enormous profits on these films, which owe more to advances in special effects technology than to inspired or scientifically accurate scripts. Scientific misrepresentation, suggesting little or no research characterize the bulk of science fiction films since Star Wars.

If we back track a little, we find that 2001, released in 1968, is the only contemporary film that offers scientific accuracy and that generated enormous income. Besides collaborating with Clarke, Kubrick's research includes date from: NASA, The Jet Propulsion Laboratory, General Dynamics, Goddard Space Flight Center, Honeywell Inc., IBM, Lick Observatory, The U.S. Weather Bureau and many more.

Unlike Hollywood studio executives, Kubrick had little fear of audience confusion, evident in the way 2001 infers nature's subtleties through filmic subtleties. Lowest common denominator marketing influences many productions as Carl Sagan points out in quoting Harlan Ellison about the inception of Star Trek:

> Even such sedate biological novelties as Mr Spock's pointy ears and permanently querulous eyebrows were considered by network executives far too daring... such enormous differences between Vulcans and humans would

> only confuse the audience... and a move was made to have all physiologically distinguishing Vulcanian features effaced.

The Star Trek example is typical of network or studio involvement in TV or film production and refers to a fundamental principle governing Hollywood thinking "None ever lost money by underestimating audience intelligence". The enormous quantity of mindless situation comedies and supposed "science" fiction films that use outer space as a backdrop for formula drama prove this maxim to be a safe and profitable practise. Therefore one of Kubrick's richest assets turned out to be his insistence that MGM act like a silent partner; executives were barred from the set giving Kubrick complete control and artistic freedom. Closed sets are a Hollywood rarity, but apparently Kubrick's previous productions afforded him this clout.

If Arthur C. Clarke, a closed set and the type and quantity of research represent the primary aspects of 2001's production, the secondary variables are also noteworthy. For example, Kubrick chose Frederick Ordway as technical consultant. At that time, Ordway was a senior research scientist at the University of Alabama, president of General Astronautics Research Corp. and had published several books. Ordway's academic orientation includes a Harvard degree in astronomy and geosciences.

Another secondary parameter was the precedent setting budget allotted for this production. Kubrick allocated $6.5 million of his $10.5 million to special effects. In 1968, a $10.5 million budget is comparable to the reported $52 million for the production of Annie. More importantly, Kubrick pioneered special effects techniques that are now staples of current science fiction film productions.

Finally, Kubrick shows more than he tells, because only 40 of the 167 minutes of 2001 has dialogue. The mute moments in 2001 tell us more than any dialogue could have communicated. For example, in the ape section called "The Dawn of Man", Kubrick begins with empty landscape shots and slowly adds signs of life, inferring the time on Earth before visible life forms existed. The transition from the ape section to the outer space section further compresses millions of years of evolution into minutes of screen time: An ape throws a bone into the air. Cut. We whizz past 1983 and go directly to 2001 and outer space; our first sight is a space ship floating somewhere in our solar system.

Scientific principles are also silently communicated especially in the spacescapes of 2001. Kubrick's spacescapes suggest access to probe and telescope reproductions - a claim few other filmmakers can make. Furthermore, man-made object movement obeys part of the parallax theory: the further away an object, the slower it appears to move. Kubrick tops this by photographing slow moving spaceships with hypnotic and lethargic camera movements.

Besides offering us a view of Earth from the moon, Kubrick gives us close-ups of our solar system's planets and natural satellites. Sometimes a fraction of a sphere takes up 80% of the frame, while a distant spacecraft is nearly a dot against the remaining background. These spheres are either completely illuminated or only partly lit; these lighting variations suggest the proximity and relative position of the off-camera sun.

Since the film frame limits length and width, Kubrick plays with depth to communicate the vastness of outer space. A moving asteroid begins as a dot in the background, for instance, and overwhelms the frame in the foreground. Conversely, in plain view, Poole is killed in space and moves towards the background ending as a dot. Up, down, left and right movements feebly introduce us to the universe's size, so Kubrick compensates by manipulating depth.

2001's spacescapes and the film's representation of zero gravity prompted cosmonaut Alexei Leonov to say: "I feel I've been in space twice", after Leonov saw 2001.

Although some point to minor flaws in Kubrick's depiction of 37% gravity on the moon, his depiction of zero gravity in a film released 15 months before the July 1969 walk on the moon by NASA astronauts was a daring gesture indeed.

Zero gravity sequences are either silent or are accompanied only by music, whereas the spaces with gravity simulation (e.g. within Discovery) always have a faint machine hum on the soundtrack, suggesting the presence of a machine that simulates the earth's gravity in outer space.

Research in also evident in Kubrick's references to radio astronomy and time delays. Radio astronomy is widely believed to be the first means of communication with aliens. The monolith emits a piercing radio signal when discovered by the apes and Floyd on the Moon, suggesting an alien's method of communicating human presence.

Time delays occur in a throwaway verbal reference. Bowman and Poole are listening to a BBC broadcast about their mission and the announcer tells us that it takes seven minutes to reach Discovery, an route to Jupiter at the speed of light.

So many futuristic speculations regarding high technology and outer space travel were boldly asserted by Kubrick in the mid-60s well before the information explosion of the seventies. By 1983, we see clearly the accuracy of most of the film's ideas. For example, many perceive a decline in verbal skills and Kubrick's 40 minutes of dialogue show us characters speaking in clipped sentences and using monosyllabic words. Moreover, the rise of visual and computer literacy is evident in the man-machine relationships shown by Kubrick. Video screens that have shots changing every 15 seconds have either complex three-dimensional drawings or coded data. Often, an astronaut watches and digests info from eight screens simultaneously. Floyd's PanAm spaceflight implicitly suggests reusable spacecraft in 2001 and by 1983 the Space Shuttle shows us this reality except that it will probably take us 'til 2001 before we have reusable passenger spacecraft.

Another aspect of future man-machine relationships is expressed more directly by the HAL 9000 computer's mutiny. Kubrick debatably asserts that humanizing a machine is an all-or-nothing proposition. Greed for power and psychosis permeate HAL's microchip circuitry resulting in multi-murders and HAL's eventual lobotomy performed by Bowman. This engaging drama and hypothetical scenario alert the spectator to the process of selective programming. HAL's programmers have implicitly selected evaluation and interpretation as two of HAL's humanoid traits. For example, HAL the art critic evaluates Bowman's drawings and HAL the lip-reader can interpret a conversation when Bowman and Poole speak outside of HAL's hearing range. Kubrick goes further by suggesting that HAL's whole is greater than the sum of its parts. In orther words, Kubrick tells us that selective pre-programming may spawn unplanned and undesirable activity.

In Kubrick's vision of the future, alien contact is as essential as a humanized computer. Unlike other filmmakers, Kubrick wisely withholds the visual representation of alien physiology. Kubrick indirectly introduces their existence through the monolith as if he is aware of what a loaded responsibility it is to commit an alien's appearance onto film.

Kubrick successfully suggests the existence of alien life without ever showing the viewer an example. Indeed, much of Kubrick's messages exist off-screen. For example, Kubrick's framed spacescapes claim only to be a split quark relative to the cosmos's whole. "The universe", according to J.B.S. Haldane, "is not only stranger than we imagine, it is stranger than we CAN imagine." perhaps Kubrick demonstrates that the universe is not only bigger than we imagine, it is bigger than we CAN imagine.

By exploiting off-camera phenomena, Kubrick assumes that his audience is intelligent and sophisticated. Kubrick offers the viewer nuance and farsightedness while many other filmmakers prefer banality and myopia.

Finally, in light of all the science fiction waste expelled from Hollywood's bowels since 1968, one shudders to consider who will be recruited to direct Clarke's recent 2010: Odyssey II.

Carol Rutter is a member of both The Royal Astronomical Society of Canada (Montreal) and the Society for Cinema Studies. Since 1981, she has been on the executive of The film Studies Association of Canada and has numerous Canadian film publication credits.

Nouveau Traité Abrégé De La Sphère

J.E. Kennedy

During the summer of 1980, while I was carrying out a survey of the books on astronomy published prior to 1900, and held by the university libraries across Canada, the information on a card in the catalogue at the Université de Montréal caught my attention. A few days later, a similar entry appeared in the catalogue at Queen's University; a copy of "Nouveau Traité" was located in their archival collection, and perused briefly. I was given a xerox copy of the treatise by Mr. W. Morley of the Douglas Library at Queen's to take back with me to Saskatoon.

One year later, a decision was made to translate this short treatise. With the assistance of Lois Wilson, a former instructor in the French Department at the University of Saskatchewan, and Professor Roger Gautier of the French Department, this work was completed during the fall term of 1981. Both Lois and Roger recommended that the original text and the translation of the treatise be scrutinized by a fluently bilingual astronomer who should detect any *nuances* which might have been overlooked at Saskatoon in the technical work of translating a document written in nineteenth century French. At my request, Dr. René Racine, Director of the CFHT, undertook this task in Hawaii; in his reply, he describes the evening spent on this checking as "great fun".

On the title page, it is clearly stated that "Nouveau Traité" was a "Nouvelle Édition à l'usage des Écoles de cette Province". Attempts have been made through colleagues and associates at the Université de Montréal and at the Université Laval to determine whether this treatise was actually used in the instructional program. So far nothing in the way of conclusive information on this point has emerged.

While I was preparing the slides for this presentation, my attention was directed specifically to the words "Nouvelle Édition". Is it correct to assume that this entry implies that there had been an earlier edition of this treatise? A search of "The National Union Catalog Pre-1956 Imprints" shows that the 1829 Treatise on "Nouveau Traité" is held at two Canadian universities, (University of British Columbia and University of Toronto) while the copies at the Université de Montréal and Queen's University are not listed. The adjacent entry in the National Union Catalog shows that an earlier edition of this treatise was prepared in 1824 "à l'usage du Séminaire de Nicolet, Trois-Rivières". The same terminology, "Nouvelle Édition", appears on the title-page of the 1824 treatise. An enquiry has been made to the Librarian at the Séminaire de Nicolet to determine if the students enrolled there were exposed to this astronomy in the instructional program offered in the late 1820's.

The entry in the National Union Catalog indicated that a copy of the 1824 edition was held by the University of Michigan at Ann Arbor. The Michigan Library provided the University of Saskatchewan Library with a microfilm that had been produced by the "Bibliothèque Nationale du Québec". Thus, one concluded that a copy of the 1824 version must exist in Canada, even though it was not shown in the above National Union Catalog. In a recent letter from Marcel Hudon, Librarian in charge of Thèses et Livres Rares at the Université Laval Bibliothèque, my attention was called to an entry in the publication: "Brochures québécoises" by Hamelin, Beaulieu and Gallichan. The Library at the Université du Québec à Trois-Rivières is reported to have a copy of the 1824 edition of "Nouveau Traité".

A search must be carried out for the original treatise on which these *new editions* are presumably based. A copy of a "Traité de la Sphère" published in Paris about 1775, housed in the Library at Columbia University, New York, may provide some information on the origin of the later brochures. An examination of certain parts of the 1824 and 1829 versions of Nouveau Traité suggests that a publication date of 1775 for the original treatise appears reasonable.

In both editions of Nouveau Traité the astronomy is subdivided into fourteen separate sections, translated as: On the Circles of the Sphere, On the Zodiac, On the Two Colures, On the Planets in General, etc. In the body of the text, it is stated that there are seven planets, not counting the earth; these are the Sun, Mercury, Venus, Moon, Mars, Jupiter and Saturn. A footnote to this section provides the additional information that Mr. Herschel discovered a planet in April 1781, which is called Uranus. If the earth is classified as one of the planets, the sun and the moon are deleted from the list, and Uranus added, then the number of planets would still remain at seven. In this footnote as well, there is mention of four new planets, now called asteroids, which were identified between 1801 and 1807.

Therefore, it might be assumed that the original treatise on the sphere was written prior to 1781, and the footnote utilized as a convenient method for updating information in the two new editions published in Trois Rivières in 1824 and in Montréal in 1829. However, in the body of the text it is stated in a subsequent section that: "Saturn is surrounded by seven small moons or satellites". William Herschel discovered two of the seven satellites of Saturn in 1789. While this apparent reversal in presentation can possibly be explained, these pieces of indirect evidence are by no means adequate for assigning a date to the writing of the original treatise on the sphere. Instead, it will be more satisfactory to locate an earlier and original copy of this work, not a "Nouvelle Édition".

Nouveau Traité is presented "par Demandes et par Réponses", a rather useful method for teaching astronomy at this level in the schools. Other approaches designed to accomplish similar results can be cited in books on astronomy published early in the nineteenth century. John Bonnycastle wrote his text: "An Introduction to Astronomy, in a Series of Letters from a Preceptor to his

Pupil, in which the Most Useful and Interesting Parts of the Science are Clearly and Familiarly Explained." Whenever a letter became unduly long, the author overcame his difficulty by adding a second letter entitled: "The same subject continued." What a pity that in the twentieth century, we have become instructors in astronomy — as "preceptors", we might well have done better.

A third approach was used in a number of texts of that period written by Mrs. Marcet. An example of her work is: "Conversations on Natural Philosophy in which the Elements of that Science are Familiarly Explained and Adapted to the Comprehension of Young Persons." In this book, Mrs. B., Emily and Caroline have a wonderful discussion on various aspects of Natural Philosophy, extending over some five hundred pages. The comments and responses of each participant clearly reveal to the reader the emphasis that the author placed on interpretation, as well as a clear understanding of the topic under discussion. In the twentieth century, where conversations are carried on so frequently with recorded messages, this emphasis may soon be lost.

There is still much to be learned about "Nouveau Traité Abrégé de la Sphère". shall seek help from archivists and librarians who have access to dusty records and indexes. I remain optimistic that none of the required information in "Nouveau Traité" has been discarded.

From a practical point of view, exposing students in the nineteenth century to the contents of Nouveau Traité was a necessity, as they lived at a time when knowledge of the stars was essential to their way of life, travelling as they frequently did through uncharted areas of forests and rivers. In the twentieth century, knowledge of astronomy is still a necessity but for quite different reasons.

Members of the three societies assembled here all place great importance to the publication and dissemination of astronomical knowledge. In closing, may commend you individually for this most fitting way of preserving in your only confuse the audience... and a move was made to have all physiologically distinguishing Vulcanian features effaced.

The Star Trek example is typical of network or studio involvement in TV or film production and refers to a fundamental principle governing Hollywood thinking "None ever lost money by underestimating audience intelligence". The enormous quantity of mindless situation comedies and supposed "science" fiction films that use outer space as a backdrop for formula drama prove this maxim to be a safe and profitable practise. Therefore one of Kubrick's richest assets turned out to be his insistence that MGM act like a silent partner; executives were barred from the set giving Kubrick complete control and artistic freedom. Closed sets are a Hollywood rarity, but apparently Kubrick's previous productions afforded him this clout.

If Arthur C. Clarke, a closed set and the type and quantity of research represent the primary aspects of 2001's production, the secondary variables are also noteworthy. For example, Kubrick chose Frederick Ordway as technical consultant. At that time, Ordway was a senior research scientist at the University of Alabama, president of General Astronautics Research Corp. and had published several books. Ordway's academic orientation includes a Harvard degree in astronomy and geosciences.

Another secondary parameter was the precedent setting budget allotted for this production. Kubrick allocated $6.5 million of his $10.5 million to special effects. In 1968, a $10.5 million budget is comparable to the reported $52 million for the production of Annie. More importantly, Kubrick pioneered special effects techniques that are now staples of current science fiction film productions.

Finally, Kubrick shows more than he tells, because only 40 of the 167 minutes of 2001 has dialogue. The mute moments in 2001 tell us more than any dialogue could have communicated. For example,

ÉTUDE DENSITOMÉTRIQUE DE FILMS ACTIVÉS

Mario Lapointe

Le club d'astronomie du Collège de Lévis s'est toujours intéressé à l'activation des films pour usage astronomique. Les expériences débutèrent en 1976 sur des films ordinaires traités à l'hydrogène pur. Au cours des années, les films se renouvelèrent et les procédés évoluèrent. En 1983, sept ans plus tard, nous vous proposons une étude densitométrique du film 2415 de la compagnie Kodak traité avec un gaz de type formine. Toute l'expérience s'effectuera en laboratoire. Cette étude vise particulièrement à identifier les paramètres les plus importants dans le processus d'activation.

Nous nous attarderons à la durée d'activation, la température de la chambre ainsi qu'à la pression. La connaissance du paramètre le plus influant permettra éventuellement d'optimiser le processus d'activation afin de diminuer la durée de ce dernier. La durée d'activation peut atteindre dans certain cas plus de 24h. Les données recueillies lors de cette expérience serviront à la conception d'une nouvelle cuve d'activation pressurisée.

Le procédé d'activation que nous utilisons comprend trois étapes. En premier, le nettoyage; le film est enroulé dans une spirale de la cuve d'activation afin que toute sa surface soit uniformément dégagée pour les étapes suivantes. Il est soumis à un vide d'une durée variant de 1 à 4 heures. Cette étape permet de soustraire l'humidité et l'oxygène de la pellicule.

Par la suite, nous passons à l'activation. Le vide est remplacé par une atmosphère de formine (92% N_2 , 8% H_2). Cette dernière sera pressurisée et chauffée. Nous pouvons travailler avec trois paramètres: soit la durée, la pression et la température. Finalement, après l'activation, le film est conservé dans une atmosphère neutre de gaz carbonique ou d'azote jusqu'à l'utilisation.

La prise de photographie s'effectue en laboratoire en simulant un ciel artificiel. Nous photographions une source lumineuse diffuse et uniforme à l'aide d'un téléobjectif de 850mm F/14 auquel nous rajoutons un filtre solaire de densité 5. Le système optique est calibré de façon à obtenir un temps de pose maximum légèrement supérieur à la limite de réciprocité, soit au moins 20 minutes. Ce système de photographie ne peut servir qu'en approche comparative. Les données sont difficilement comparables à un autre système. Dans cette étude, nous avons réalisé les activations suivantes: soit une durée de 18h à une température de 50°C et une pression de 5, 10 et 15 livres/pouce carré, et une seconde série d'une durée de 18h à une pression de 15 livres/pouce carré et une température de 40 et 60°C, la température de 50°C ayant été réalisée dans la partie précédente. Le temps de pose des photographies s'échelonnent de 30 secondes à 20 minutes avec un intervalle croissant dont la moyenne est d'environ 3 minutes.

En tout, une cinquantaine de photographies furent prises et analysées. Cependant, cette technique est longue et, par conséquent, dû à un manque de temps, l'analyse de la durée d'activation en tant que paramètre a été abandonnée.

Une fois les photographies prisent, les films sont développés dans les mêmes conditions et en utilisant la chimie recommandée par le fabricant. Par la suite, la densité de chaque plaque est prise. Il s'agit de la densité moyenne de la plaque. Le densitomètre utilisé est un Macbeth TR-524 calibré en STATUS M. Nous obtenons alors le tableau de données nécessaire pour l'analyse.

Nous calculons la fonction mathématique de la densité en fonction du temps pour chaque film étudié. Cette fonction est calculée à l'aide d'une calculatrice HP-41C et d'un programme d'ajustement de courbes. Le programme nous donne aussi le coefficient de corrélation entre la courbe et les points expérimentaux. Ce dernier varie entre 0.90 et 0.98, ce qui est très bien.

Ainsi, après analyse, nous observons qu'une augmentation de la température de la chambre augmente la pente de la courbe de la densité en fonction du temps. Cette dernière a généralement la forme d'une exponentielle de type $Y = Ae^{Bx}$. Cependant, l'analyse de la courbe obtenue, en réalisant la dérivée mathématique des courbes précédentes, démontre un maximum. C'est-à-dire qu'après une température donnée la pente de la densité en fonction du temps diminue, démontrant ainsi une moins grande rapidité du film. Cette température a été évaluée à 53°C.

En ce qui concerne la pression, l'analyse est plus difficile à faire. Le résultat du calcul des pentes, à partir des fonctions trouvées, sont plus instables en fonction du temps. En gros, cependant, on note qu'une augmentation de la pression augmente la rapidité du film, mais que cette augmentation ne semble pas linéaire. Seules des analyses réalisées à des pressions plus élevées permettront de vérifier ce comportement.

Dans cette analyse, il faut tenir compte que nous avons peu de données, vu le nombre assez faible de films traités. Pour qu'une telle expérience puisse donner des résultats plus intéressants, il nous faudrait au moins 5 à 6 films pour une variation d'un paramètre. Ce qui représente un total de plus de trente films. Cependant, pour atteindre ce nombre de films, il serait souhaitable d'avoir un procédé d'analyse plus rapide. Par exemple, l'utilisation d'une méthode basée sur la sensitométrie ne demanderait qu'une photo par film traité.

En conclusion, même après toutes ces années, il reste encore bien du travail pour l'astronome amateur désireux d'approfondir le domaine de l'activation des films par procédé gazeux. Dans cette expérience, nous n'avons atteint qu'en partie les objectifs de départ. J'espère que cette courte étude saura éveiller chez certains un intérêt pour ce domaine assez particulier de la photo astronomique. Je tiens à remercier l'entreprise "Phosalac" de Chicoutimi pour le prêt du densitomètre nécessaire à cette expérience.

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SOLAR SPECTRAL OBSERVATIONS AT SACKVILLE,NEW BRUNSWICK,CANADA

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A combined operation of the triple techniques of experimental astrophysics - visual,photographic, and photoelectric - is presented here as a project relating to solar and solar related geoatmospheric spectra in two parts, Visual and photographic results are given in Part-I, and photometric results in Part-II.

Editor's note: unfortunately, the reproduction process used is not fair for the details seen on Mr Iyengar's original pictures.

SOLAR SPECTRAL OBSERVATIONS AT
SACKVILLE,NEW BRUNSWICK,CANADA - I

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Paper presented at the 1983 General Assembly of the Joint Astronomical Meeting of the RASC, AAVSO,and AGAA, at the University of Laval,Quebec City.

INTRODUCTION

More than sixty five elements are identified to-date in the sun through its spectrum with the help of laboratory reference spectra of known sources. Solar spectrum has its origin at different regions. Continuous spectrum originates in the photosphere,absorption spectrum in the chromosphere, ion spectrum in the corona and the so called flash spectrum of emission in the chromosphere during the totality of an eclipse.All these point to different elements in the atomic or molecular state,whether neutral or ionised.Thousands of absorption lines,(these are called Fraunhofer lines), of chromospheric origin are known. Ground based observations in the visible and radio regions and spece-borne instruments covering IR, UV, X-ray and Gamma-ray regions have constituted a wealth of knowledge.

Shapes of spectral lines of varying intensities are obtained from microdensitometers.Narrow band interference filters are used to isolate wavelengths of interest and to compare with spectra of known sources. Prisms and gratings are used to disperse frequencies. High resolution instruments, faster films for photographic spectroscopy,and sensitivity extending to wider regions have added to precision and convenience with speed.Multiplier photo tubes have made photometry more useful. Chart recorders and other memory units have made possible easy storage of spectral information.

SCOPE OF THE PRESENT WORK

This paper refers to the solar work done by the author in Atlantic Canada at Sackville,(46° N,64° W),in New Brunswick.It is a combined operation of the triple techniques of experimental astrophysics; visual,photographic and photoelectric. The first two - visual and photographic- are combined as Part-I here,and the photometric work is separated as Part-II for convenience.Solar energy interacts with the constituents of the earth's upper atmosphere causing absorption and emission processes. These are of spectroscopic and photometric interest. Accordingly,in the multi-wavelength photometry in Part-II, the selected lines are of both astrophysical and geophysical interest.The project itself was conceived as a means of motivating research oriented university seniors in experimental astrophysics.

PART- I

VISUAL -(SPECTROMETRIC)

A Hilger spectrometer was employed to measure wavelengths directly. It uses a constant deviation prism and its wavelength separation in the blue is larger than in the red region.The drum is accordingly graduated to take care of this property. Initial adjustments are made to ensure that standard lines such as He-Ne laser 6328 Å, Hg-5460 Å are precisely lined up with the pointer in the field of view of the eye-lens. The entrance slit for light is set as narrow as practicable.

Solar radiation entered the system directly through the slit from the east in the morning and from the west in the evening. At other times a reflector was suitably used, sometimes with a condenser lens to focus light on the slit. As many as a hundred absorption lines were directly measured. These were also graded, according to the visual estimates of their relative intensities, as s^+, s and s^- in respect of strong lines; similarly, w, vw and vvw in respect of weak lines; the last vvw being barely visible. Wavelengths are given in Table-I

PHOTOGRAPHIC -(SPECTROGRAPHIC)

The Hilger spectrometer was modified,by replacing the telescope by the camera system,into a spectrograph. Kodak Tri-X or Super XX and high speed IR film, the last mentioned, for the red region, were used. Optical interference filters conveniently isolated the required wavelengths from the rest of the continuous spectrum. An absorption line,in some cases,(for example,K-7650) could be seen clearly and sharply in the middle of an emission line isolated with a filter. Exposure times were suitably used from a fraction of a second to a few minutes depending upon the conditions of sunlight entering the slit,directly or through a filter. Laboratory sources of light appropriate to the context were used to record reference spectra.

PHOTOGRAPHIC SPECTRA

Fig.1 shows the spectrograph used for the work presented here. In a solar spectrum so obtained by ground based work it is natural to have contributions of geoatmospheric emission and absorption also.

Fig.2 shows such a spectrum in the middle row. A Hg-spectrum is given in row 1 at the top and a Cd-spectrum in row 3 at the bottom. On careful inspection, it is not difficult to match some lines, whether emission or absorption, in the middle row with Cd lines 4678, 4800 and 5086 Å; and similarly, with Hg lines 4915 and 5460 Å, eventhough such lines in the recorded spectrum in the middle row might be very weak. These lines could be of geoatmospheric origin or local contamination.

In the spectrograms of Fig.3, rows 1 and 2 show the lines K-7650 and Na-5896 Å from laboratory sources. Rows 3 and 4 show these lines isolated from the continuous solar spectrum using filters. These include Li-6710. Laboratory Li source was not on hand. Row 5 at the bottom of Fig.3 shows solar spectrum without any filter. Absorption lines appearing as dark lines are clear at these wavelengths, although Li dark line is too feeble to be seen.

Fig.4 is a magnified spectrogram containing the rows 3-5 of Fig.3. A thin and dark line is sharply visible at the centre of each of the emission features of K-7650, Na-5896 and Li-6710; The last mentioned is again somewhat weak relative to others.

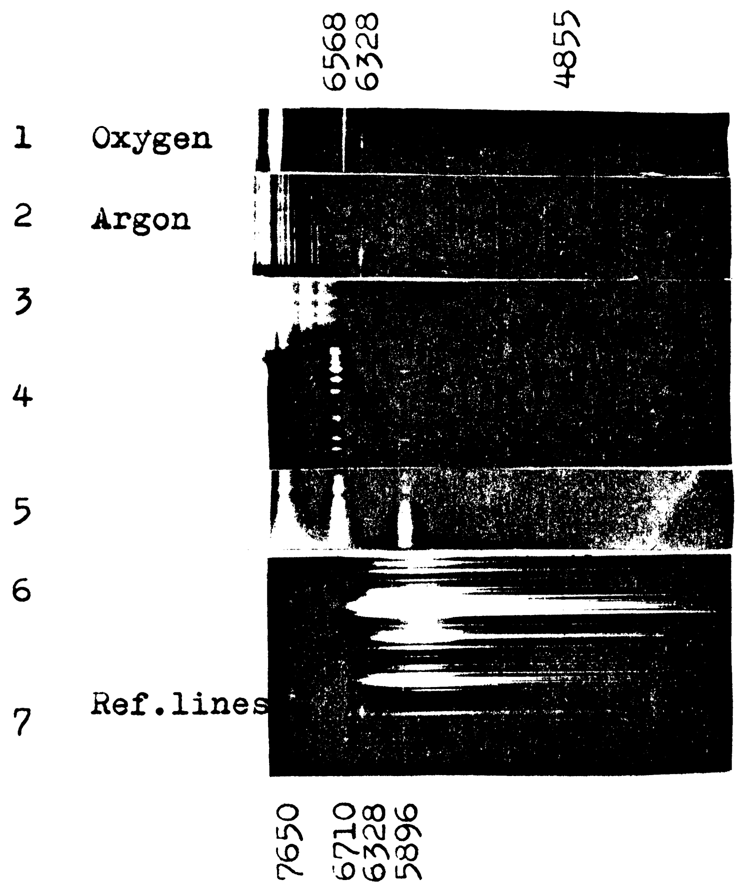


Fig.5

3 to 6 are all solar + geoatmospheric spectra; 4,and 5 with appopriate filters at those wavelengths; 3 and 6 without any filter. 3 is an evening spectrum around sunset.

Reference lines 6328 and 5896 are used at the bottom of 6 (shown as 7).

Part of oxygen bands in 1 and lines in 2 due to Argon are included in the band system (emission) seen in 3.

Laser reference line 6328 is seen in each of 1 and 2 (sharp,thin and short mark).

The emission lines are easily of atmospheric origin. The absorption lines at these wavelengths are solar,with possibly overlapping geoatmospheric absorption,if any.

The two spectrograms of Figs.5 and 6 identify lines or bands of nitrogen,oxygen,argon,hydrogen and deuterium. Some of these are, of course, of geoatmospheric origin; especially, nitrogen and oxygen. Suitable laboratory sources were used to get reference spectra in the red region. One of the hydrogen sources used contained a 50% mixture of deuterium and hydrogen. This has given clear Balmer lines of hydrogen in Fig.6,(top row) for comparison with those of the solar spectrum. Careful inspection perhaps could find lines or bands of emission or absorption in the solar spectrum matching with those of deuterium also. Filters at some of the wavelengths of deuterium would make it easier.

The red region of the solar (+ geoatmospheric) spectrum photographed in rows 3,4 of Fig.7 is presented with comparison spectra of Xe, Ne,and N_2 in rows 1,2 and 5 respectively. The bright bands and dark lines in the red region in rows 3 and 4 may be matched with some of the lines of the sources used. The dark line K-7650 Å is sharp and marked. A He-Ne laser line 6328 Å is used as a reference marker, as can be seen.

Three hydrogen lines of the Balmer series H_α, H_β, and H_γ are shown in the spectrogram of Fig.8.

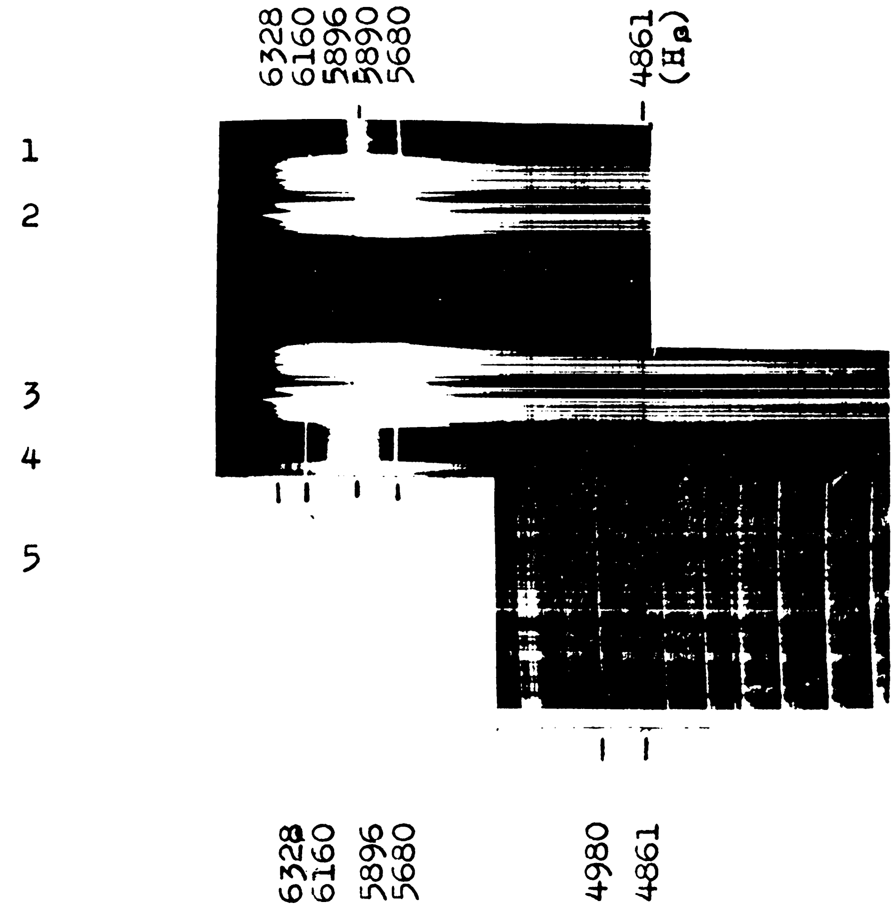


Fig.9 Nitrogen emission and absorption features (bands and lines) of geoatmospheric origin may easily be seen to correspond to the laboratory source spectrum of Nitrogen (bottom) superposed on the solar+geoatmospheric spectrum.

Several reference lines of a laboratory sodium source and the 6328 reference line from a He-Ne laser are also shown with their wavelengths.

The hydrogen line Hβ (4861) of absorption in the solar spectrum is clear and sharp; (dark line).

Laboratory reference bands of nitrogen are superposed on the solar(+geoatmospheric) spectrum in row 5 of Fig.9. H_β of the solar spectrum and Na-4980 Å emission line from a laboratory source are also clear in row 5 of Fig.9.Rows 2 and 3 contain solar spectrum (+ geoatmospheric). It is easy to see that emission lines and bands in these, and absorption lines and bands, correspond with those in the superposed laboratory spectrum of nitrogen.Rows 1 and 4 show reference spectra such as He-Ne 6328, Na-6160, 5890+5896,and 5680;Na-4980 is clear in row 5,as a reference line.

TABLE I

Fraunhofer lines (dark absorption lines) and bands observed at Sackville, New Brunswick, (44° N, 64° W), Canada, using a Hilger wavelength spectrometer.

The notation s^+, s, and s^- used here would indicate the decreasing order of their relative strengths. Likewise, w, vw, and vvw would indicate weak to barely visible lines. Wavelengths are in Å.

7235	s^-
7200 7190 7150	s wide
7040	s^-
6930	
6915	
6878	s^+
6565	s^+
6542	wide
6515	vvw
6505	vvw
6496	w
6475- 6462	wide
6445	wide
6315	
6292	
6278	s^-
6262	
6170	s^-
6158	w
6145	s^-
6100	w

5955	s^-	
5945	s^-	(")
5920 5901	vw	(")
5896 5890	s	(")
5880 5870 5864	vw	(''')
5708		
5662		
5615		
5608		
5590		
5405 5398	s^-	
5370 5363	w s^-	(")
5345	w	(")
5332 5325	s^- s	
5292	s^-	(")
5282 5270	s s^+	
5263 5258	s	(")
5250		(")

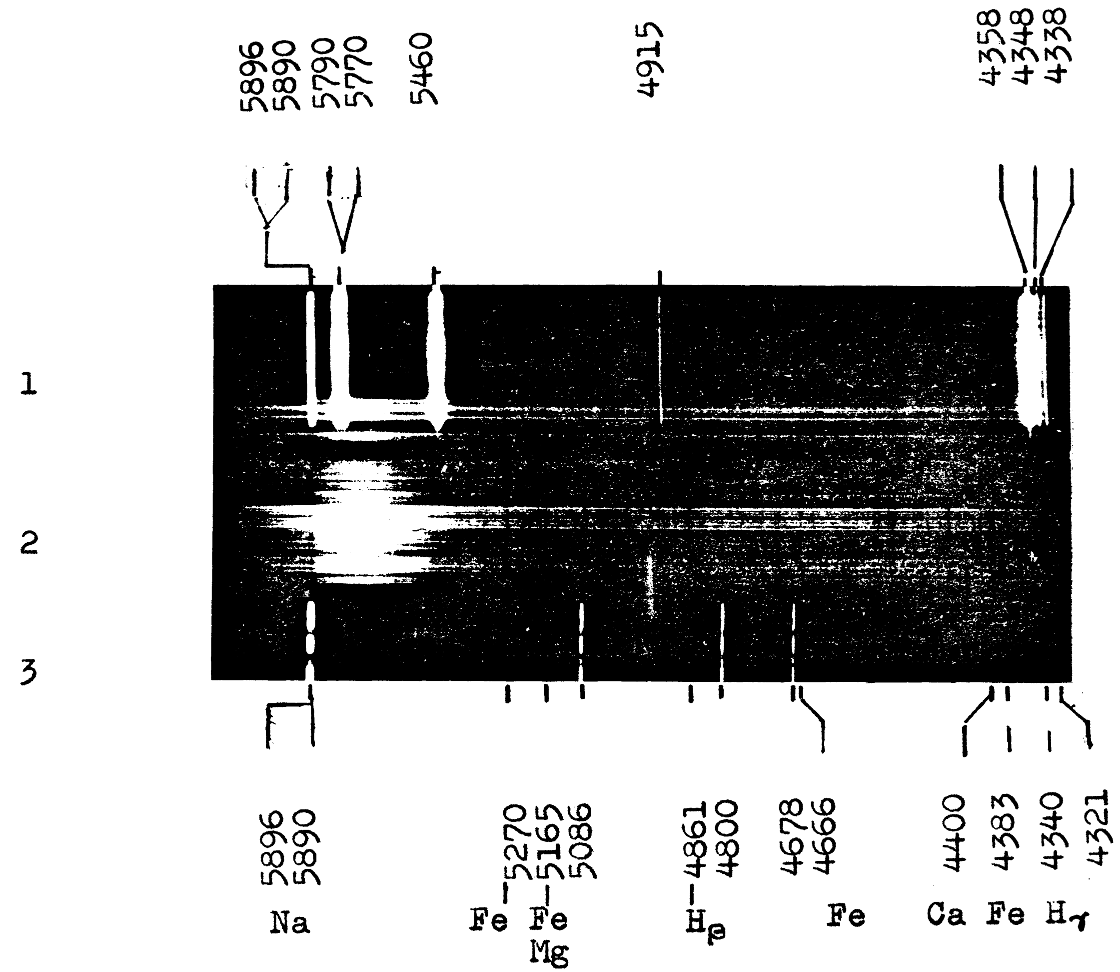
TABLE I (continued)

5250	w		(||)
5227 5223	s^-		(||)
5215	w		
5206	w		
5193			
5180	s		
5166 5162	s^+		(||)
5107			
5096	s^-		
5077	s^-		
5045	w		
5038	s		(||)
4990	s^-		
4980	s		(||)
....			
4971	s		(||)
....			
4951	s		
4938			(||)
4919	s		(||)
4888	s		(||)
....			
4865	vw		(||)
....			
4861	s^+		(||)
....			
4765			
4730			
4666	s^+		
....			
4545	s		
4528	s		
....			
4453	w	wide	
4400	s^+	wide	
....			
4383	s^+	wide	
....			
4343	s^-		
4325	s^-	(emission-like wide band features in the region)	
4312	s^-		
4308 4303 4300	s^+		(|||)
4268	s	wide	(||)
4220	s	wide	(||)
.....			
not visible any more			

(||) two lines close together
(|||) three lines close together
.... possibly some weak lines

Spectrograph set up for solar spectral observations,visual and photographic.
(photo by Vineeth Iyengar)

Fig.1



Solar + geoatmospheric spectrum, (part of the visible region), flanked by reference spectra of Hg (top) and Cd (bottom).

An additional reference line (5890+5896) from a sodium source is seen (left extreme).

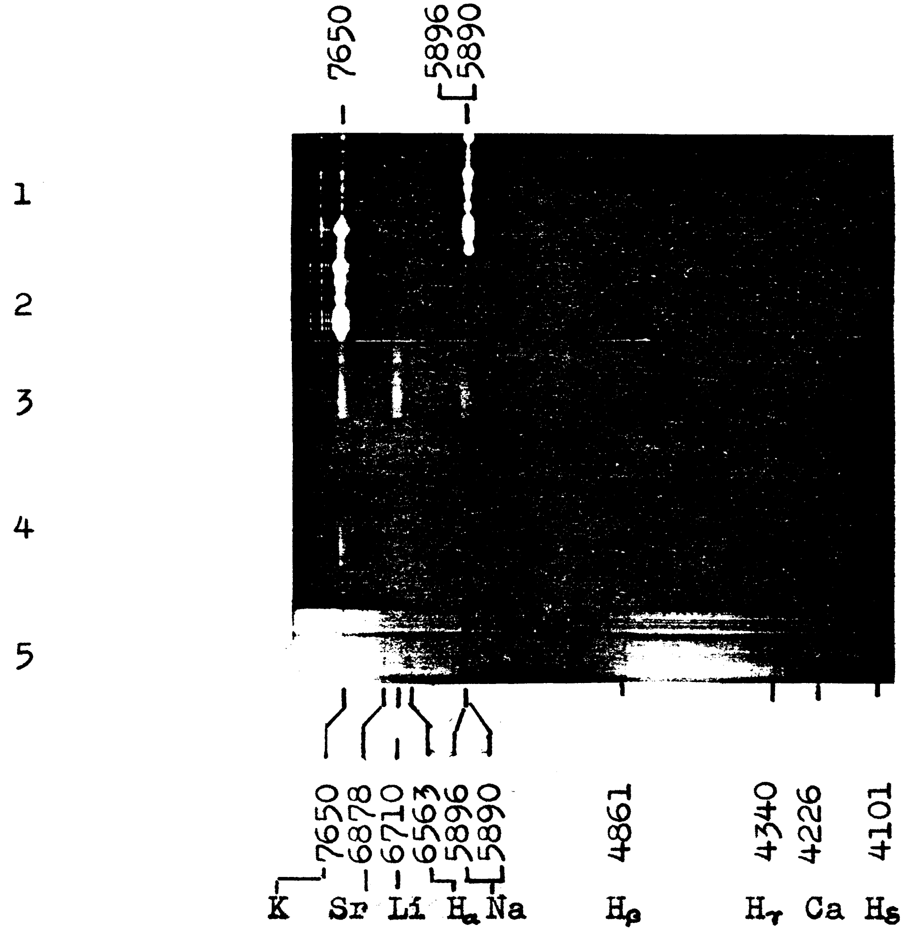


Fig.3

1 Sodium reference lines
2 Potassium reference lines
3,4 Solar+geoatmospheric
with filters at the indicated
wavelengths
5 Solar+Geoatmospheric
[redacted]

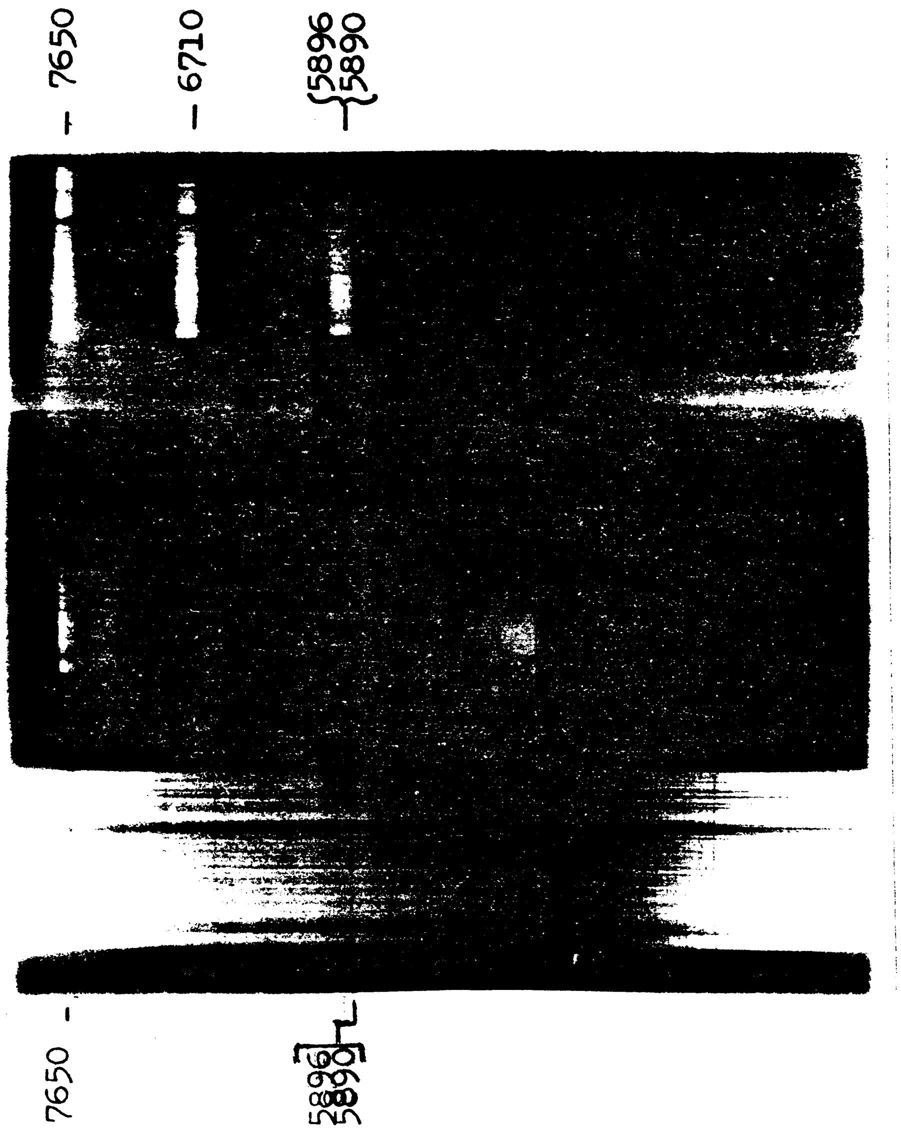


Fig.4 (Top and middle) K-7650, Li-6710 and Na-5896+5890 with filters; (Bottom): without filters. Various other Fraunhofer absorption lines of the solar spectrum are clear in the bottom spectrum. Weakly seen is also [redacted]

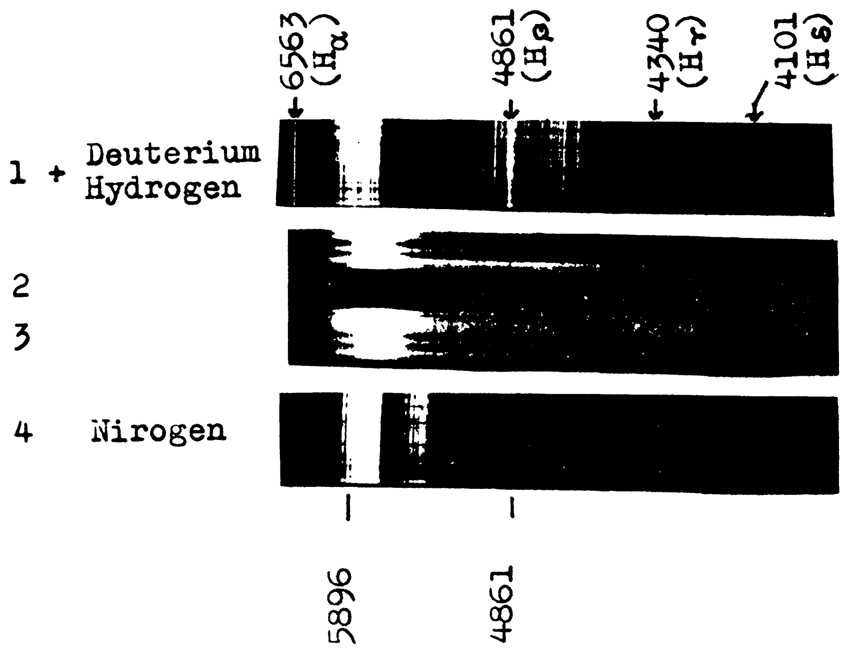


Fig.6 1 (top):Deuterium+Hydrogen(50 %);

2,3: solar+geoatmospheric spectra

4 (bottom) Nitrogen gas

Emission and absorption features due to deuterium of solar origin may be easily found on careful inspection of the spectra; as also nitrogen bands and lines of geoatmospheric origin.

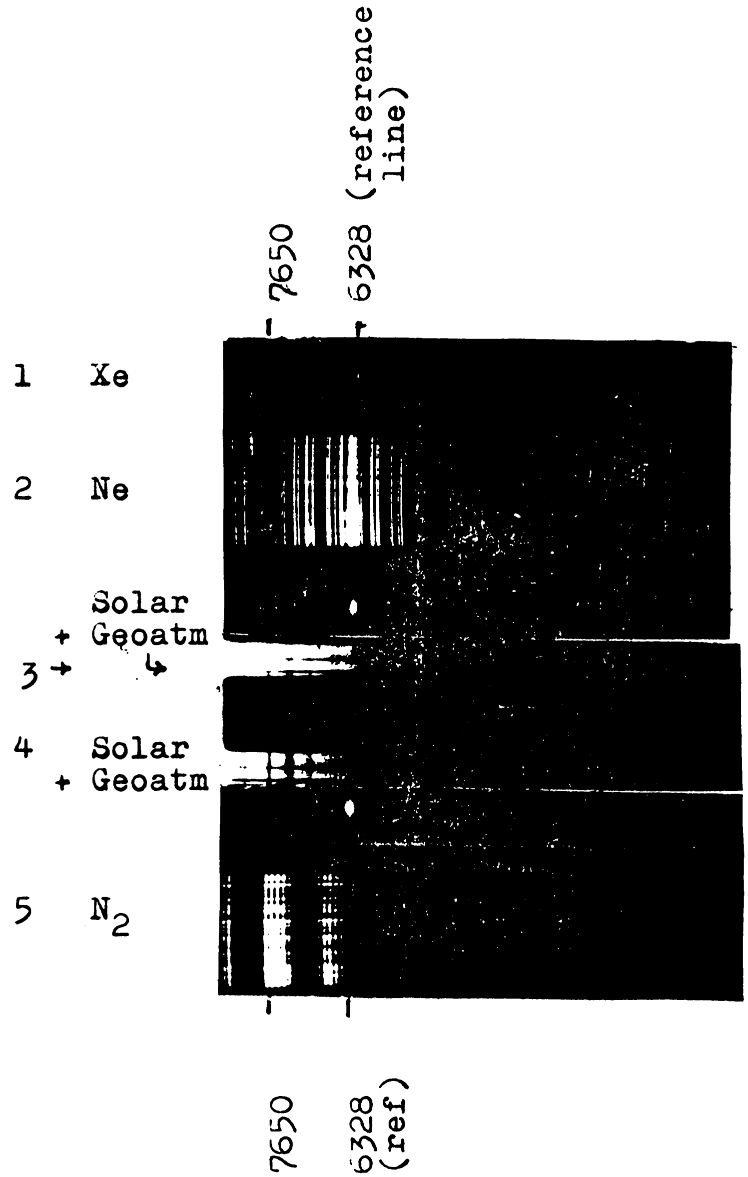
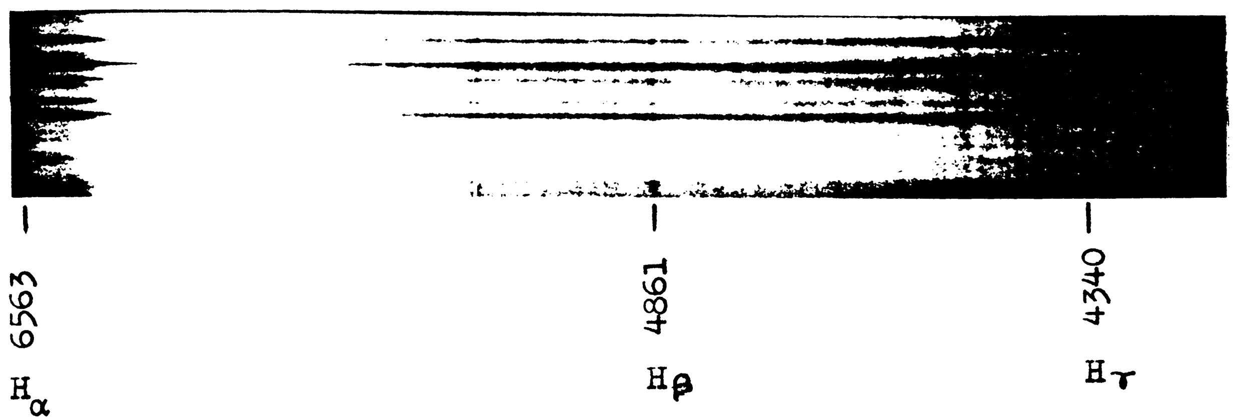


Fig.7 Comparison spectra of Xenon, Neon, and Nitrogen gases (discharge tubes) with the solar + geoatmospheric spectrum in the red region only. A simple Wratten type red filter used with IR sensitive film.

A reference line 6328 from a He-Ne laser is used to ensure that the different rows of spectra are precisely positioned with no latteral shifts from one to the next.

An absorption line(K) 7650 is sharp and shown (dark line) in 3 and 4.



Absorption Balmer lines of hydrogen in the solar spectrum photographed (without any filter) using a Hilger spectrograph.

Fig.8

SOLAR SPECTRAL OBSERVATIONS AT
SACKVILLE,NEW BRUNSWICK,CANADA - II

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SOLAR SPECTRAL OBSERVATIONS
AT SACKVILLE, NEW BRUNSWICK -II

PHOTOMETRIC OBSERVATIONS

The photometric system used for the work presented here is shown in Fig.1, with its components as in the block diagram in Fig.2. A rectangular block 12.5 x 25 mm, of dielectric interference filter constitutes the unit A. It serves not only to single out the selected wavelength from the continuous spectrum of the solar radiation, but also as entrance for light. Its thickness is less than 6.4 mm, center wavelength has ± 20 Å tolerance, and bandwidth has ± 15 Å tolerance. Its transmission outside the passband is less than 0.01 %. Unit B in Fig.2 is an optoelectronic device. It is an FPT 100 phototransister. The diameter of the lens at its top is 5.08 mm. An amplifier and a current-to-voltage converter constitute the unit C. The output signal is recorded on a Hewlett-Packard 680 M chart-recorder, which constitutes the unit D.

MULTILINE PHOTOMETRY

Hydrogen, sodium, potassium, and lithium, all have Fraunhofer absorption lines in the solar spectrum; although it is very weak in respect of Li-6710, (see Part-I). Solar energy interacts with the upper atmospheric constituents-whether atomic or molecular. Absorption and emission processes of spectroscopic and photometric interest occur. Besides, alkali emissions in the earth's upper atmosphere under solar control are known to occur. Hydrogen emissions occur during solar disturbed conditions of the upper atmosphere. Accordingly, the selected wavelengths for multiline photometry are H_α-6563, Na-5896, K-7650 and Li-6710 Å.

PHOTOMETRIC POTENTIAL FOR PHYSICAL PROCESSES

Variation of the incoming energy at the selected wavelength is seen in the signal variation. Its rise and fall would mean increase and decrease of the incoming energy. Sometimes the incoming solar energy is modified by its interaction with the constituents of the upper atmosphere. There may be a partial absorption and sometimes this absorption might be substantial. Absorbed energy might be re-emitted at the same frequency and sometimes with some modification. The incoming energy might, be, sometimes, a combination of both solar and geoatmospherically contributed. This would be due to the emission processes. The full intensity of emission could be seen in the signal peak; and depletion of the emitting constituent, in the dip.

The depleting constituent might be replenished by processes in the environment of emission and the dipping signal might recover. This would leave a trough, or valley or bay-like appearance of the recorded signal. Depletion time would be given by the interval between a peak and a dip (lowest point of signal); and the replenishment time, between this dip and the next peak.

Relative rates of reactions relating to formation and depletion of constituents are of interest in the signal processes; as also, relative height distribution of the emitting constituents. An earlier onset of drop in signal, (for a steady decline), at one wavelength than at another would be due to an earlier depletion; and this latter, due a more rapid reaction. On the other hand, at times such as around a sunset, the rays of sunlight sweep the different height layers, and out of the topmost where the emission ceases last. Accordingly, the onset of drop of a steadily declining signal occurs later than that at another wavelength from a lower height layer.

Relative steepness of signal reflects the relative rates of reaction; and relative signal level, the relative abundance of atoms. Similarity of features of signal at different wavelengths would arise from a common mechanism so causing them, although the signal strengths are different.

Some of the foregoing physical processes are illustrated in the following section. It is neither intended here nor possible to exhaust applications or potential of the photometric method. Bulk results and generalisations so derived are not the purpose here. Only when permitted by repeated observations, some general hints are indicated.

OBSERVATIONS AND RESULTS

General Signal Features

Eastward, zenithal, and westward photometric views show a gradual signal rise, high activity and then a decline; eastward in the morning, zenithal in the afternoon, and westward in the evening; (Figs. 3 and 4). A morning activity of Na-5896 Å, eastward is seen in Fig. 3 and afternoon zenithal Li-6710, in Fig. 4. This is a typical feature as the sun progresses through the photometric field of view.

In Fig. 4, on the left, Na-5896 is also seen with Li-6710. The former starts dropping sometime after Li does. Li depletes first. The steepness of decline is not much different for the two constituents; they look almost parallel. Na signal is stronger as seen, in real time, around 14:55 by switching filters. Accordingly, atomic abundance is greater in respect of Na. The time differential between Na and Li in their onset times of signal drop is further referred to in the next section.

The coruscation feature of the signal of Li-6710 on the

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right in Fig.4 is probably a signal property on this particular occasion, as the sky was visibly free from clouds. It was a clear day and sunny. Perhaps no other comment is proper at this stage on the coruscations.

Absorption Features

Fig.5 illustrates a clear dip in the signal as the sun approaches the zenith on this occasion in respect of H_α-6563. After about one-half hour, recovery is seen. The resulting feature looks like a valley. It is seen to the same extent at the same hours on two successive mornings. Probably some ionospheric disturbance triggered this type of event. The feature of the signal is very much like the cosmic noise absorption at radio wavelengths seen sometimes during solar disturbed conditions of the ionosphere. The speciality of the H_α-event here is that after two successive days, it disappeared. Such bay-type events are further watched out.

Multiline Signal Covariations

Fig.6 referring to the same hours of three adjacent evenings shows striking similarities of signal features at three wavelengths. The top two referring to Li and K, though on the same voltage scale, and though with similar features, have different signal strengths. Na-5896 signal at the bottom is on a higher voltage scale and is definitely different in strength, relative to the other two. Similar features must be due to similar mechanisms in their generation processes.

Relative Abundance of Atoms

Fig.7 shows the relative abundance in real time, relating to the constituent atoms at four wavelengths, in terms of their signal strengths. Na is more abundant than K around 15:30, Li more than K around 16:05 and Li more abundant than H around 17:00.

Depletion Order of Emitting Atoms

As the sun progresses out of the photometric field of view, emission ceases and signal declines. The onset of the drop in signal to a steady decline has been watched for the different wavelengths selected, and in real time;(Fig.8). Morning Li depletes first, while Na last. K drops a little sooner than Na. In a set of events closely adjacent, referring to evening activity, (Fig.9), the three constituents Li, Na and H_α deplete very much around the same time, but in that order, as seen in real time; K recorded four days adjacently, drops later, even after allowing for the sunset time differential. The onset of depletion in respect of Li recorded several days apart in Fig.10 is almost around the same time as in Fig.9. The sunset time differential is not reflected at all in these events.

Height Layers of Emission

As the sun's rays sweep out of the various layers causing emission, the constituent whose signal drop starts last is the topmost layer. In Fig.9, K is seen to drop last of all, and this is the top layer. This is with reference to the setting sun. There will not be much light left to illuminate the lower layers as the rays are moving out.

On the other hand both in Fig.8 and Fig.4, a differential in the onset time of signal drop can not be interpreted only in terms of the height differentials of the different layers. There will be some rays to illuminate the lower layers even when the sun progresses out of the photometric field of view. Ionisation and excitation at the lower layers would still be possible. Reaction rates relating to depletion would also be involved besides the height effect. Thus the morning depletion (Fig.8),and afternoon depletion (Fig.4),are not that simple as the evening depletion of Fig.9.

Furthermore, the relative height distribution deduced from the time differentials in Fig.9 may become different on a different evening much farther apart.The order deduced is is not a generalised result.

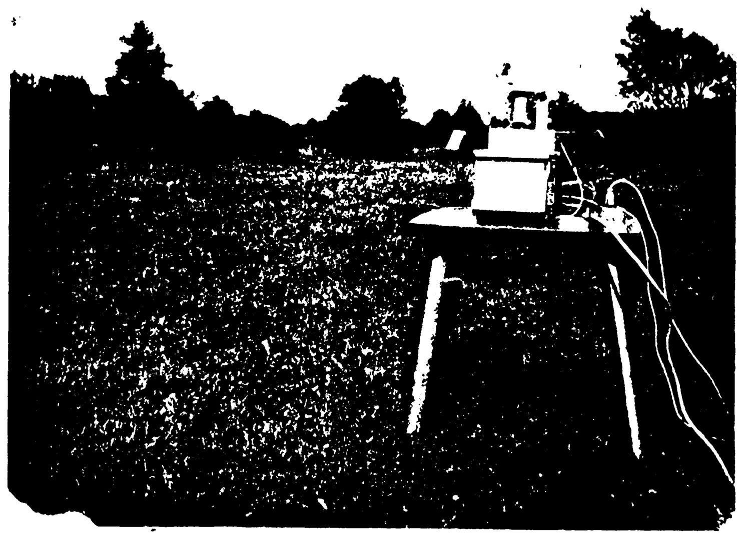
Time Scales of Atomic Depletion
And Replenishment

Figs.9 and 10, for steadily declining evening signal, illustrate some repetitive peaks and troughs on it. They do not constitute an ideal oscillatory feature.Nevertheless, peak-to-peak time scales may be meaningful,suggesting repleni-shment of energy to the emission threshold. These are Li (360), Na (960),and K (1170). The numbers in parentheses are time scales in seconds.As it is not an ideal oscillation of signal in each case, the measured times dip-to-dip are Li (270), Na (1140) and K (1620). In either case, Li is the fastest and K,the slowest in replenishment or depletion in the events of Figs.9 and 10.

CONCLUDING REMARKS

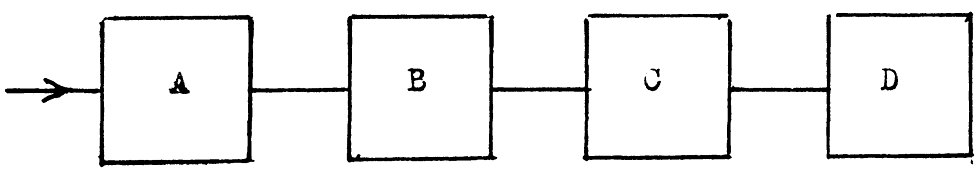
The triple techniques of experimental astrophysics - visual,photographic and photometric combined together, this project was presented at the 1983 General Assembly of the Astronomical Meeting of the RASC-AAVSO-AGAA,at Laval University,Quebec City. It has been organised into two separate parts here for convenience.

My thanks are due to the Physics Department of Mount Allison University for the support. My son Vineeth not only helped with his company during many solitary hours of continuous observations and during week ends, but also with some of the photographs presented here.



Set up of the Photometer System for solar spectral components; (Photo by Vineeth Iyengar)

Fig.1



Block Diagram of the Photometer System:

A:Entrance for Radiation and Filter
B:Opto-electronic Device
C:Amplifier System
D:Recording System

Fig.2

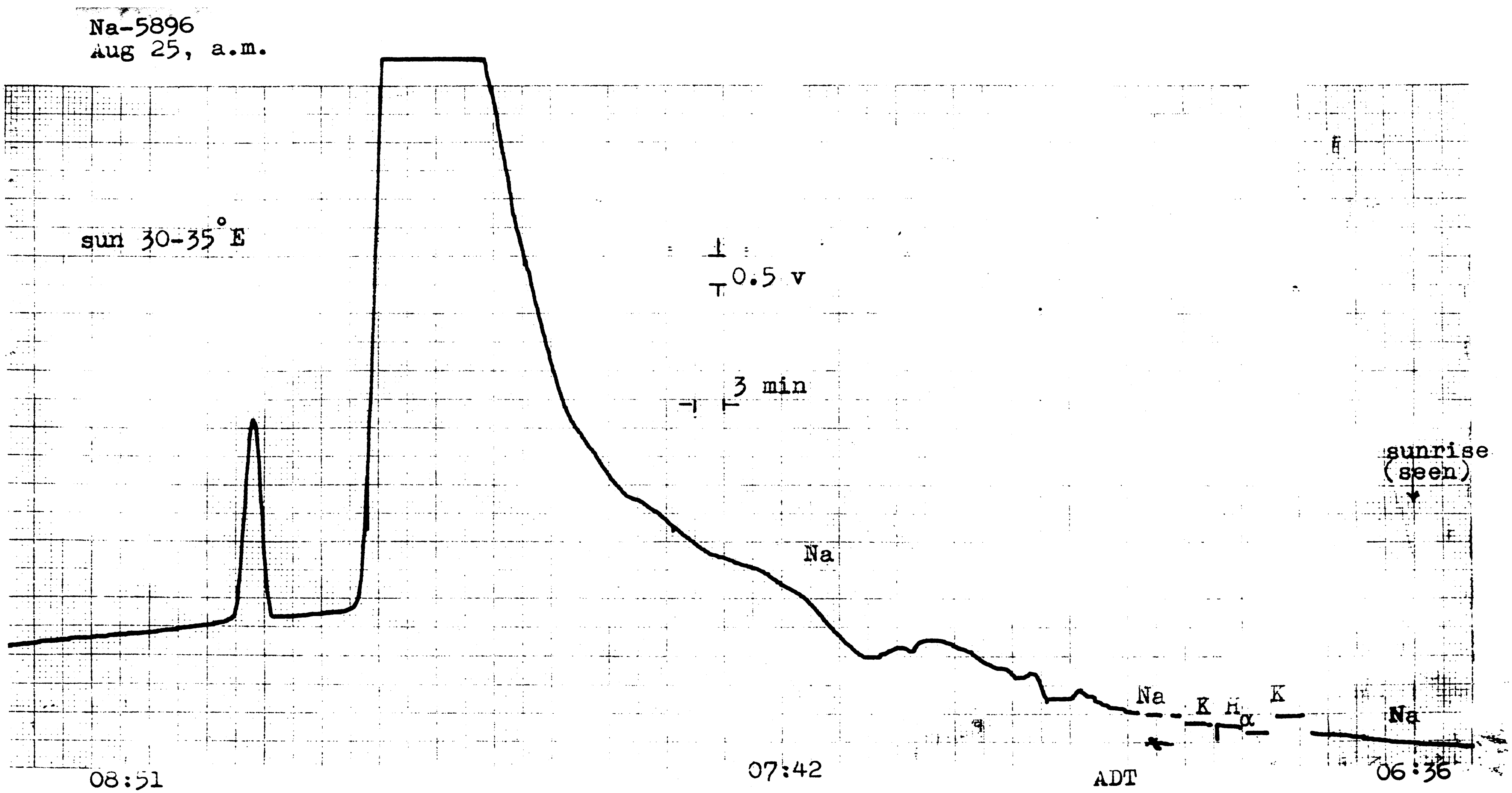


Fig.3

Eastward 0-5° photometric Na-5896 from sunrise. Maximum of the scale used is attained around 08:12 a.m, local time in summer, and a drop in the signal strength is seen very rapidly thereafter.

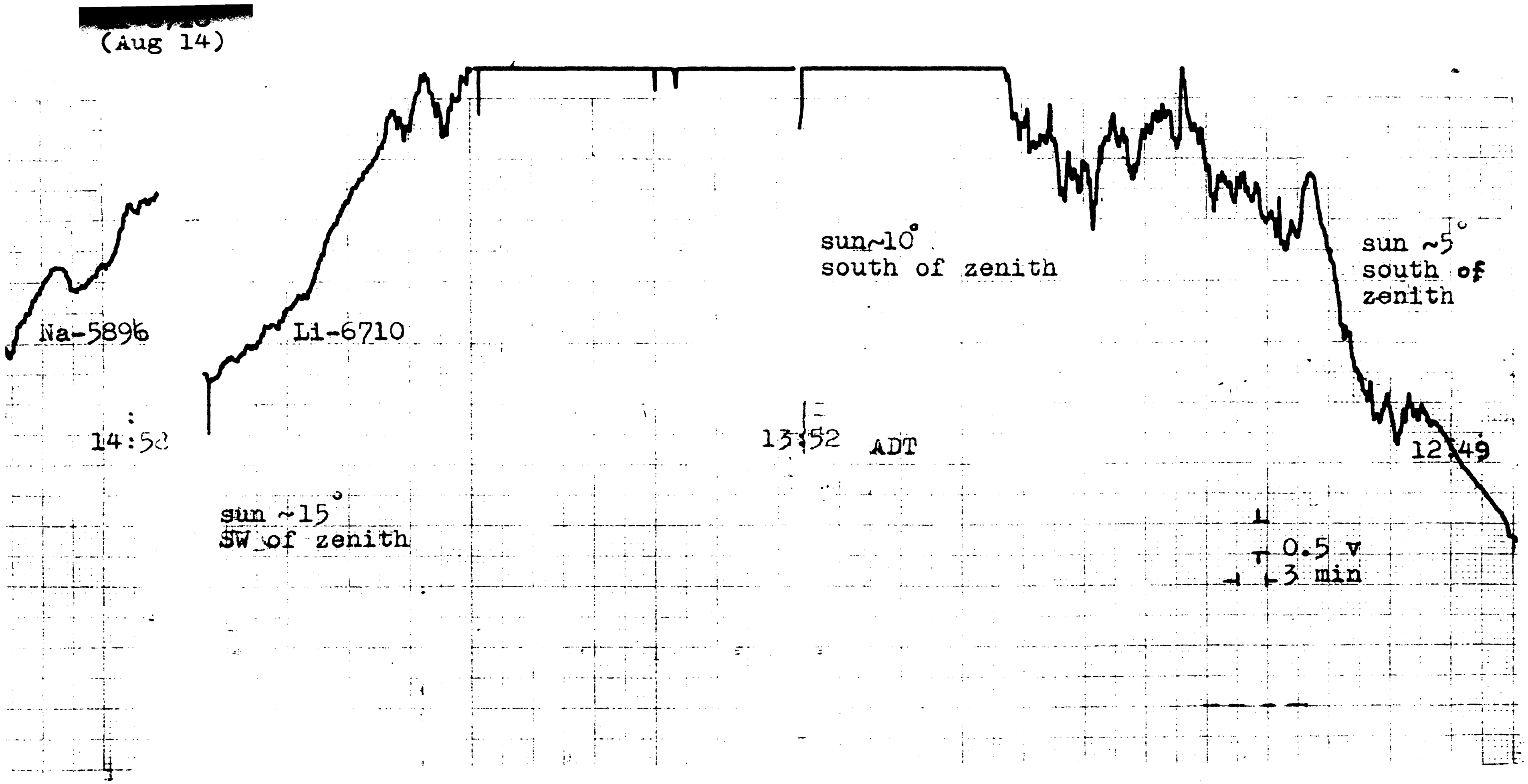


Fig.4

Daytime Li activity on Aug 14, when the Perseid meteor shower activity is at its maximum. After a peak period of activity, (zenithal) registering signal off scale, it drops off around 14:26 ADT; Na-5896 follows soon after.

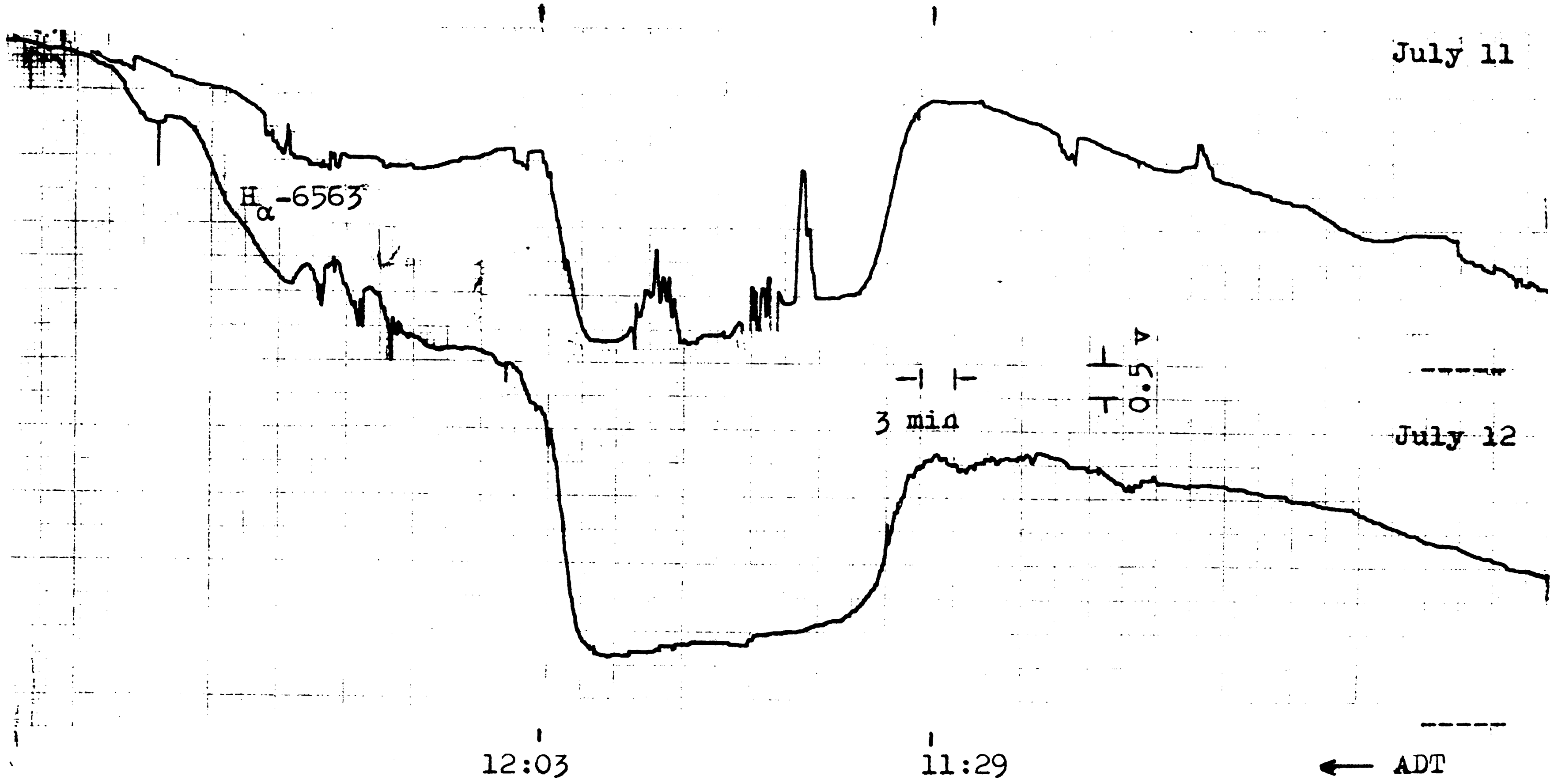
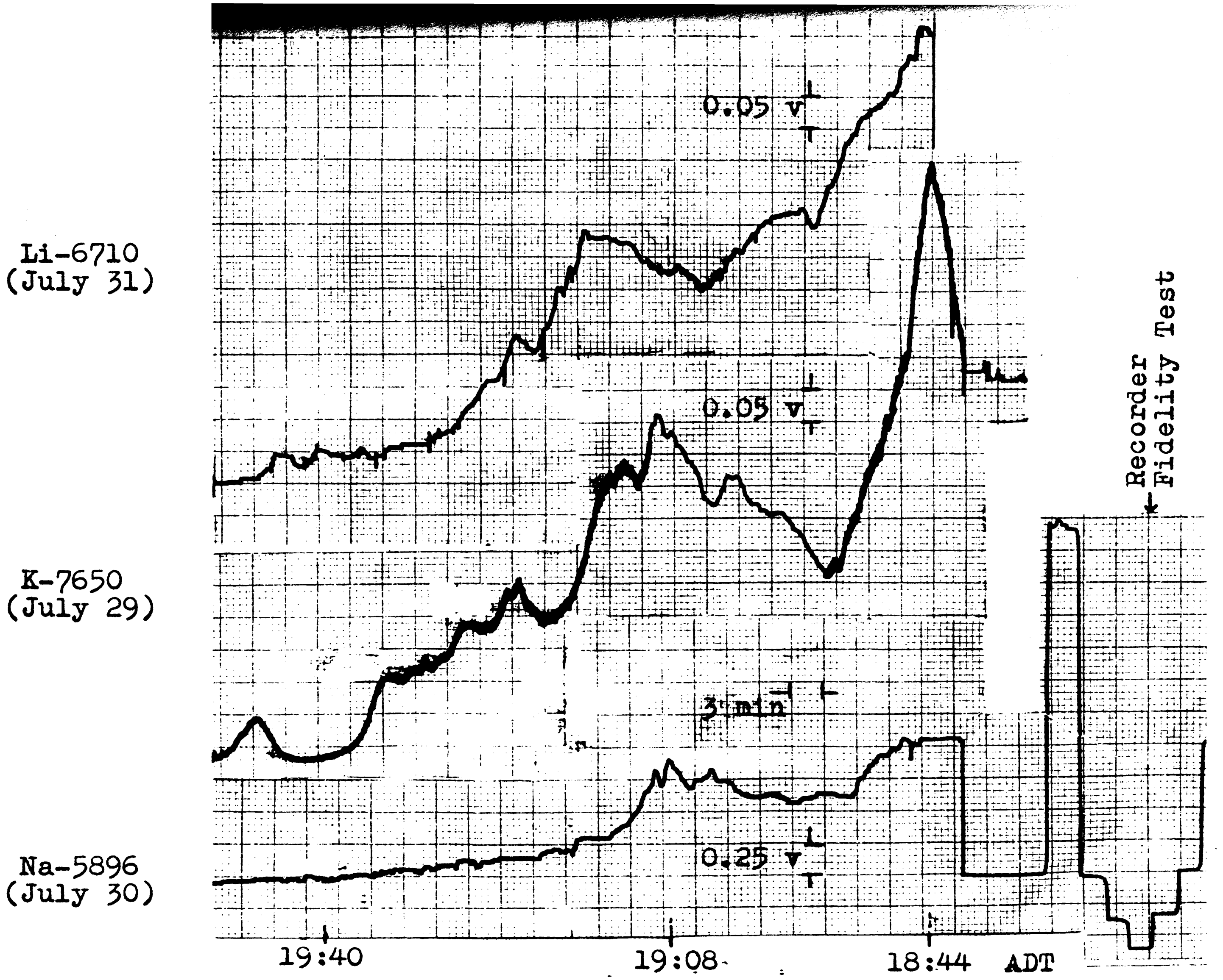


Fig.5 Dip in the signal level (absorption) of H_α-6563 of solar+geoatmospheric origin, as the sun approaches the zenith; (44° N, 64° W); zenithal photometric view. The daytime photoemission in the local ionosphere undergoes this conspicuously intense absorption due to the penetrating solar radiation; two consecutive days (in summer). Recovery occurs in about one-half hour. A signal peak is attained about an hour after this event.



Absorption (downward signal) and emission (upward signal) are seen in respect of all the three alkali elements as the [illegible] progresses through the evening (30 - 15° above the western [illegible]; zenithal photometer; three consecutive days.

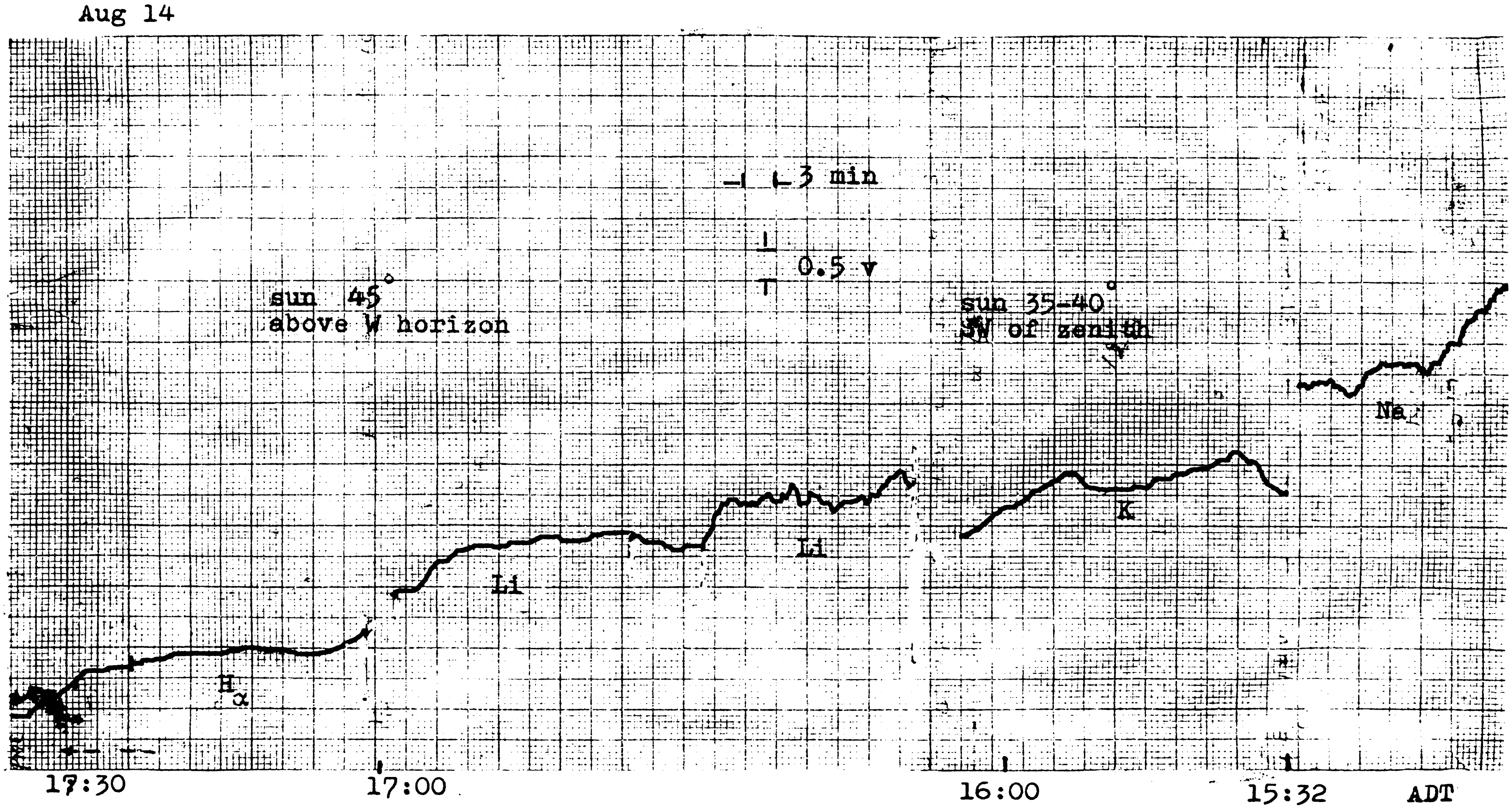
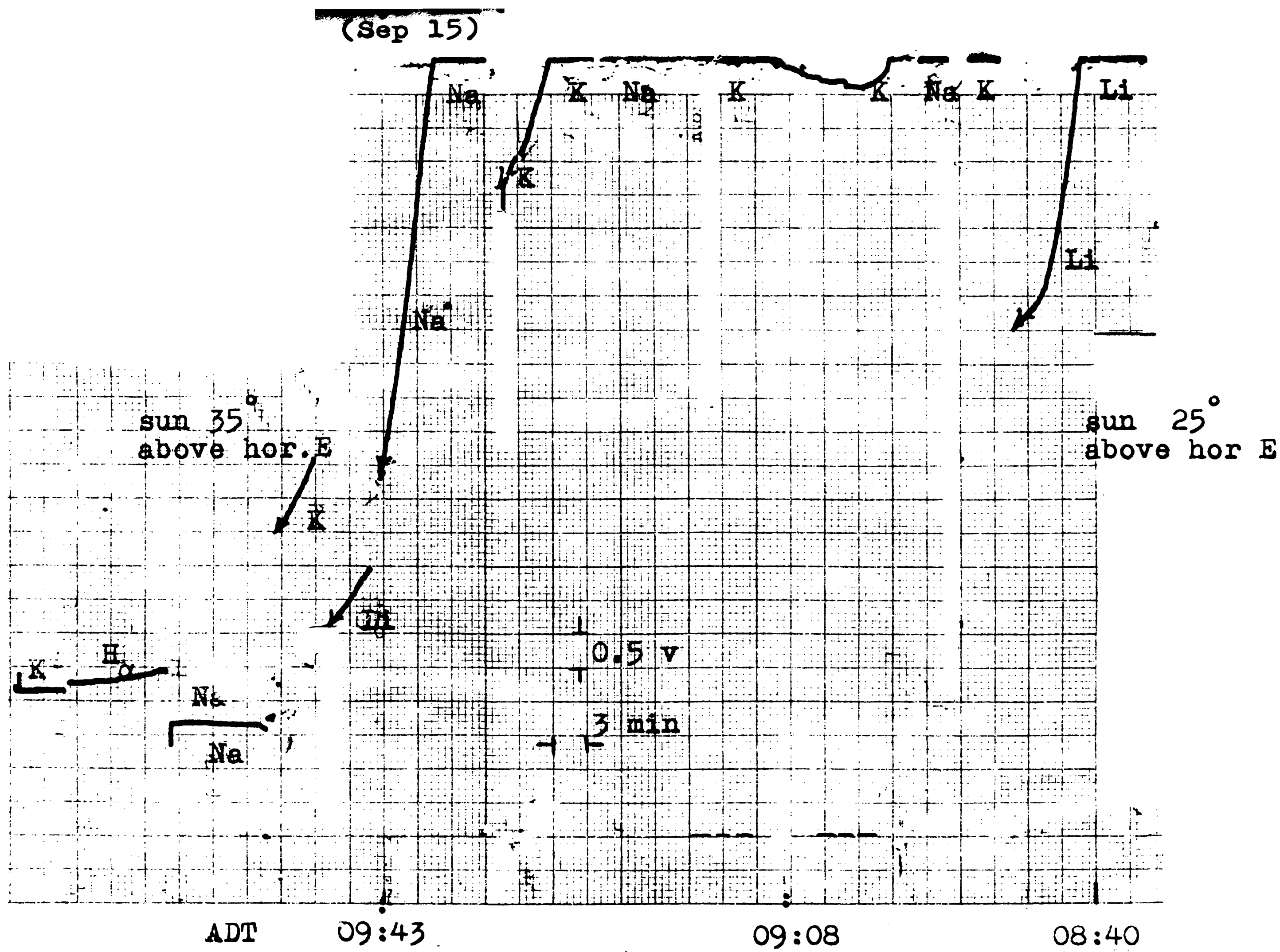


Fig.7 Real time signal variation of the three alkali elements and hydrogen. Li around 16:00 hours is comparable in strength to K;and around 17:00 hrs, is slightly stronger than H_α. (zenithal view)



Morning activity in the eastward (0-5° above horizon) direction drops off for a steady decline of signal in respect of Na,K and Li as the sun progresses from about 25° to about 35° above horizon; Na drop below the full scale occurs about 10 minutes after that for K.

Fig.8

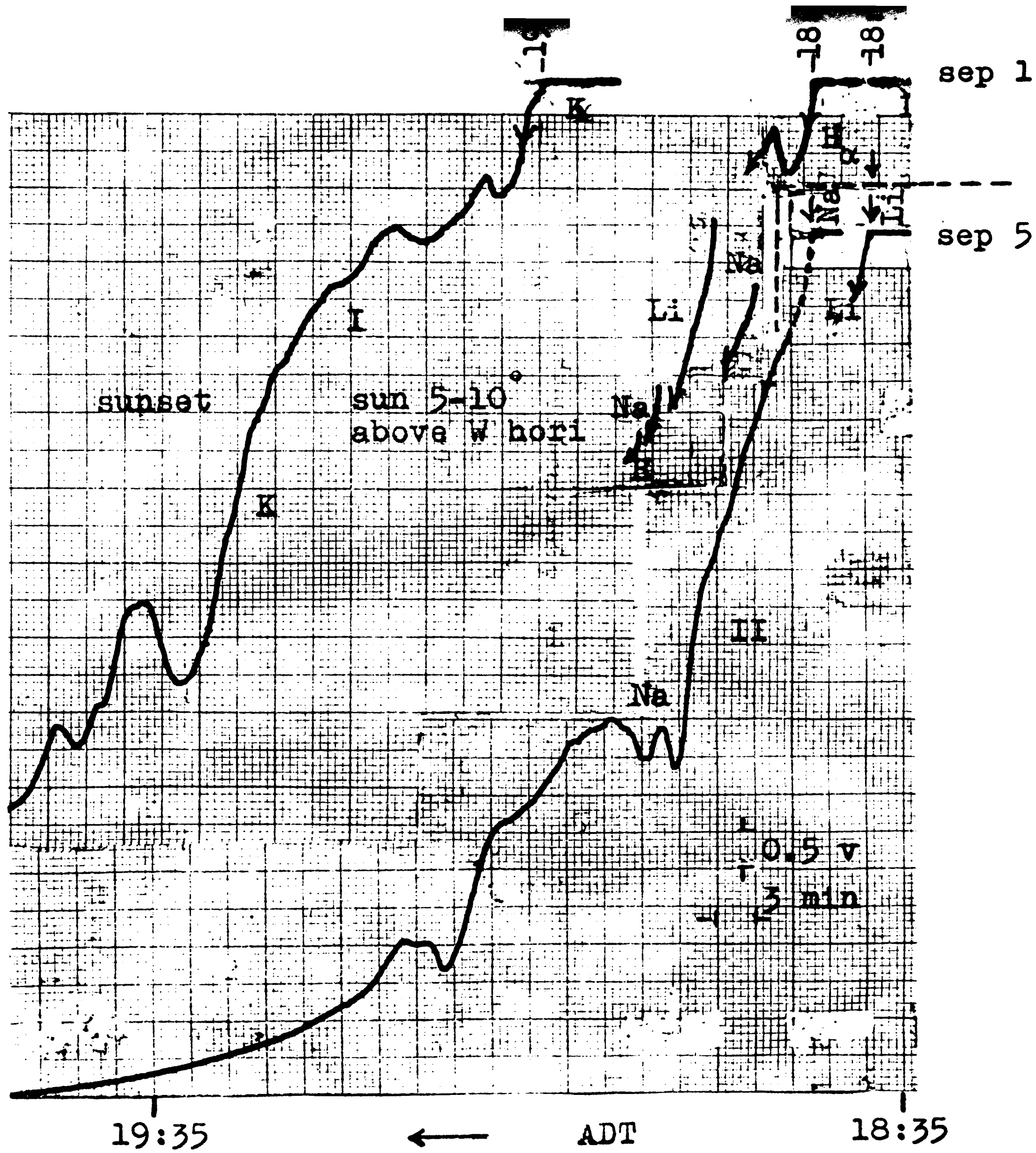
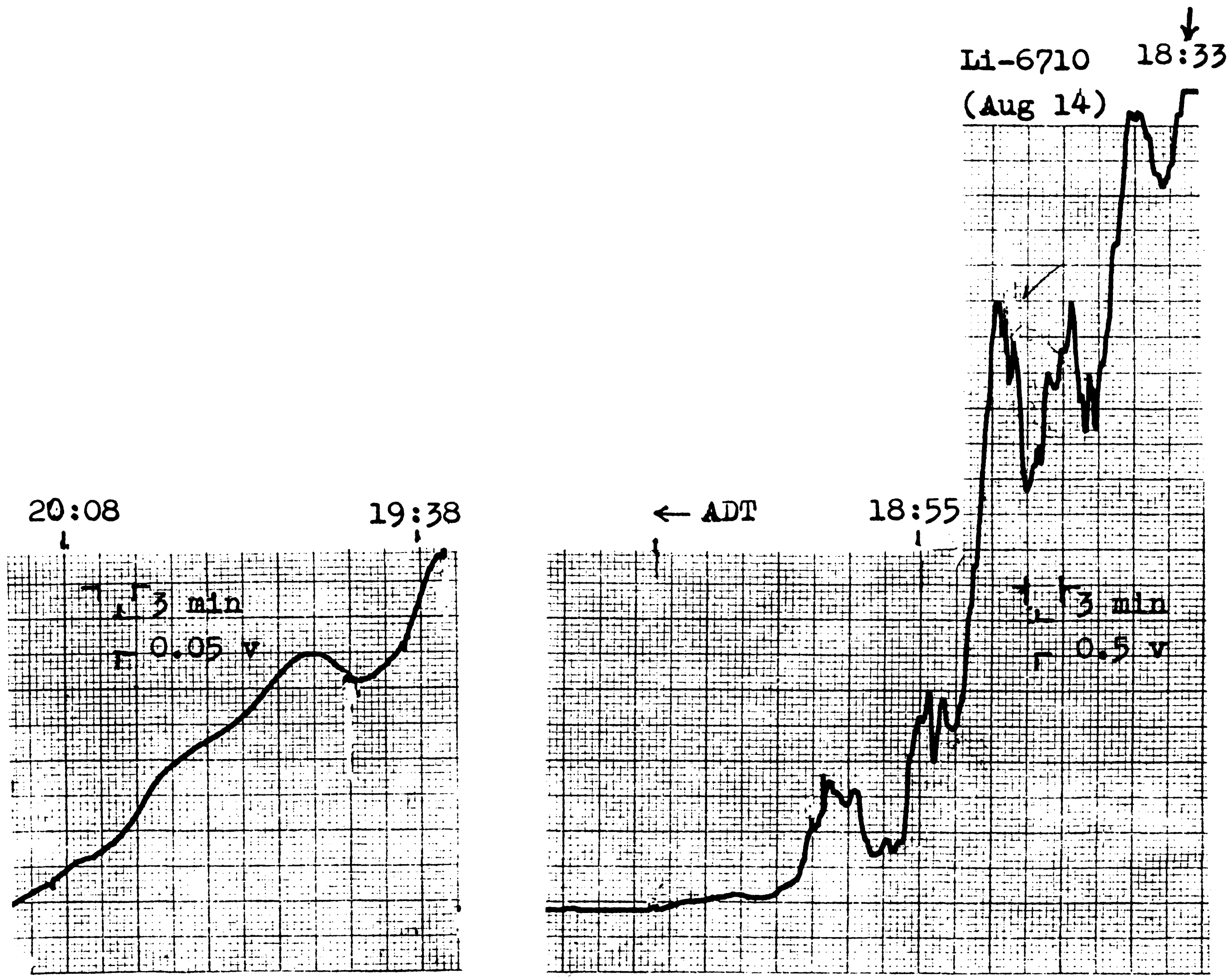


Fig.9 Real time tracking of the onset of the downward trend of the signal,(in the signal voltage range employed), in respect of Na,K,Li and H_α.The first to drop off is Li while the last is K,as the sun progresses towards the western horizon and sets. The height layer of photoemission is thus seen to be the highest relatively for K. [illegible] 5 (II), photometric view westward



Westward 0-5° view; sun 0-5° above horizon,W (setting).

Westward 0-5° view; sun 10-15° above western horizon.

Fig.10

THE CHEMISTRY AND PHYSICS OF COMET HALLEY FRAGMENTS

by
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The two meteor showers, Eta Aquarids in May and Orionids in October, consist of fragmented material from Comet Halley. The meteoroids of cometary showers do not, in general, fall to the earth as meteorites and hence their chemical and physical properties must be studied by observations from ground stations, using all available wavelength regions in the electromagnetic spectrum. The purpose of this paper is to summarise briefly the parameters of the Comet Halley meteoroids as compared with those of other major showers. In round figures the mass range of the meteoroids studied lies between 0.01 and 100 grams.

Meteoroids with a high bulk density will be decelerated less in the atmosphere than those of low density. Analysis of the best photographic observations has shown that the Geminid meteoroids have the highest bulk densities while the Giacobinid meteoroids are by far the most fragile, with very low relative densities (Refs. 9,7). This is why the Giacobinids (J) have their visible paths well above the standard meteor heights, while the Geminids (G) are well below, see Fig. 1 (Refs. 3, 4). The Comet Halley meteoroids are in between the two extremes but somewhat closer to the low-density, high-fragmentation particles.

Ceplecha's classes for meteor showers, A, B, C_1, C_2 (Refs. 1, 2) depend on the most frequent heights of appearance of the meteor trails, after the velocity effect has been allowed for. Class A showers (δ, τ, ι) appear relatively low in the atmosphere with short trails, evidence of meteoroids with high density and easy fragmentation. Class B showers (G, D, Q) have medium to high density with more resistence to fragmentation. Class C showers have a tendency to high fragmentation and are generally of low density. C_1 refers to the lower velocity showers (T, α), C_2 to the higher velocity showers (P, E, O) and includes the Comet Halley meteoroids. The Giacobinids (J) are so extreme in high fragmentation and low density that they do not fit into any of the above classes (Ref. 6).

The spectra of the Comet Halley meteoroids are similar to those of the other high velocity showers, i.e. the Perseids and Leonids (Refs 5, 7). Atomic lines of Na, Mg, Si, Ca, Fe are prominent and, with the exception of Na, both the neutral and the singly ionized atoms are observed. The relative abundances of these elements appear to be similar to those found in the carbonaceous chondrites and in the sun. All meteoroid spectra of good quality exhibit the lines of the atmospheric atoms O and N, the bands of N_2, and in many cases the lines of H and the bands of CN, C_2 and possibly CH (Ref. 8). It is believed that at least some of these H, C and O atoms originate in the cometary meteoroids.

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CAPTION - Figure 1

The heights of cometary meteors of the major meteor showers plotted against the speed of these meteors in the atmosphere.

Dashed curved lines (— — — —), the beginning and end heights of a standard meteor. (Ref. 4)

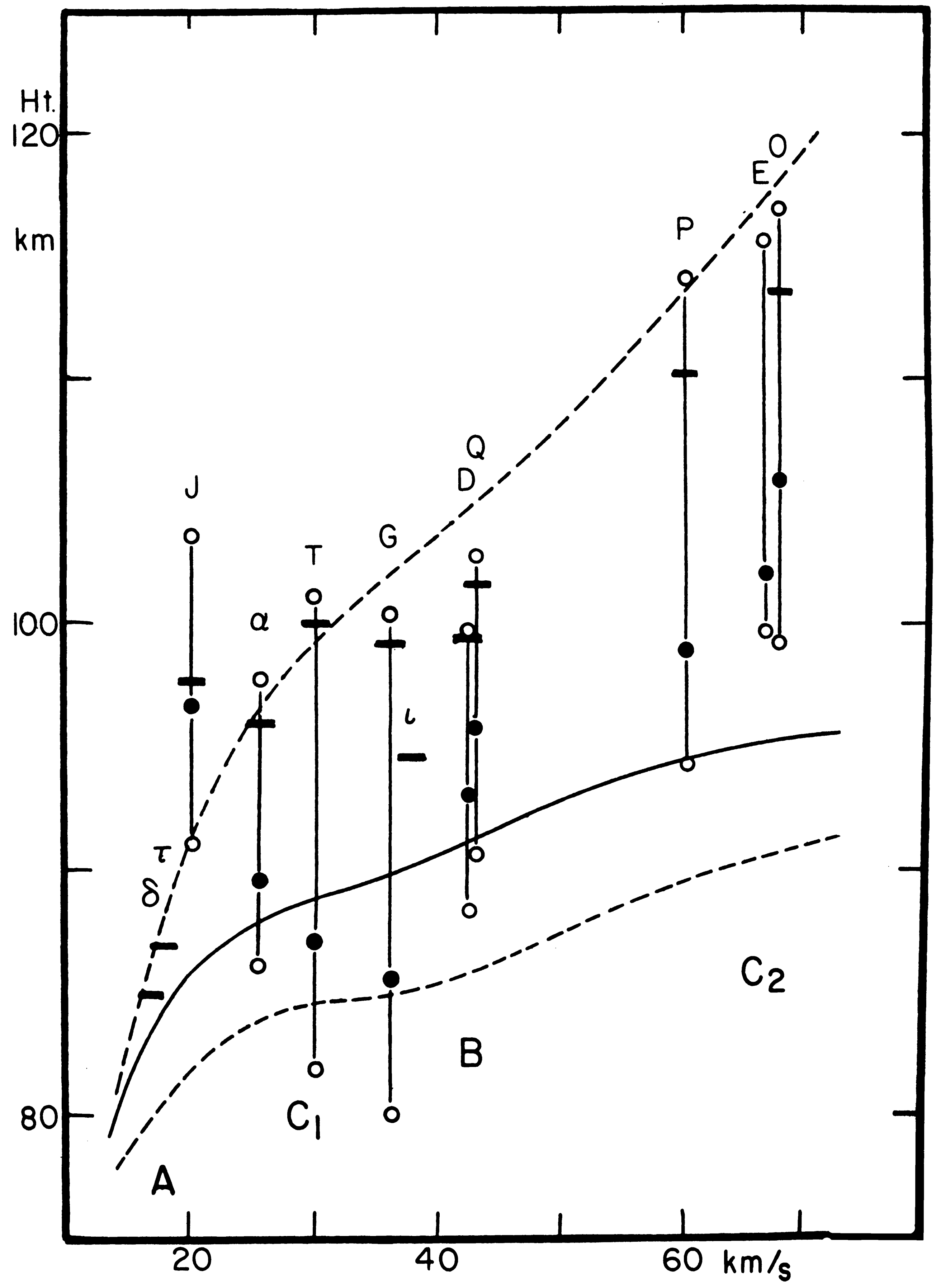
Solid curved line (————), the height of maximum light of a standard meteor. (Ref. 4)

Abbreviations for meteor showers:

D - Sδ Aquarid	E - η Aquarid	G - Geminid
J - Giacobinid	O - Orionid	P - Perseid
Q - Quadrantid	T - Taurid	α - α Capricornid
δ - δ Arietid	ι - Sι Aquarid	τ - τ Herculid

Open circles (○), the beginning and end of shower-meteor trails. (Ref. 4)
Filled circles (●), the maximum light of shower-meteor trails. (Ref. 4)
Horizontal bars (▬), heights of beginning of shower-meteor trails. (Refs 2,3)

Letters A, B, C_1, C_2 refer to Ceplecha's classes of meteor showers. (Ref. 1)


Ht.
120
km
100
80
20
40
60 km/s
J
α
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O
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δ
A
B
C_1
C_2

REPORTAGE PHOTOGRAPHIQUE DU SOLEIL

Sylvain Veilleux

La conférence porte sur un reportage photographique du Soleil couvrant la période du 17 août au 28 août 1981.

En plus d'une caméra 35 mm, un téléscope de type Newton (200 mm, f/6) a été utilisé pour effectuer ce reportage. Ce dernier était muni d'un filtre Solar Skreen ne laissant passer que 0.001% de la lumière incidente du Soleil. La méthode de projection par oculaire (9 et 25 mm) a été utilisée lors de la prise des photos. Le film Panatomic-X (32 ASA) fut choisi pour son grain relativement fin et sa faible sensibilité.

Parmi les 100 photos prises en tout, 50 furent sélectionnées puis agrandies sur du papier noir et blanc 8"X10". Des techniques de chambre noire telles que renforcement et masquage ("dodging" et "burning-in") furent utilisées pour tenter d'améliorer les photos originales. En particulier, elles m'ont permis de diminuer l'effet d'assombrissement du bord du Soleil.

La dernière étape du reportage consistait à l'analyse des photographies. La description de chacune des photos a été faite sur des fiches individuelles. On y retrouve entre autres les coordonnées géographiques du lieu d'observation, l'heure de l'observation, les conditions atmosphériques, les détails relatifs à la prise de vue, au développement et à l'agrandissement. La dernière partie de la fiche consiste à l'analyse en tant que telle de la photo (i.e. classification et brève description des groupes solaires).

Avant de discuter de la classification des groupes de taches, il serait bon de mentionner leurs caractéristiques importantes. Les taches solaires sont composées de deux parties distinctes: une région sombre, l'ombre, entourée d'une région plus claire et de structure filamenteuse, la pénombre. Leur température est environ 2000°C inférieure à la température moyenne de la surface du Soleil. La longueur moyenne de ces taches est de 10 000 km. On a cependant déjà observer des taches qui mesuraient jusqu'à 150 000 km! L'une de leurs plus importantes caractéristiques et qui, on croit, leur confère leur existence est qu'elles possèdent en leur sein d'énormes champs magnétiques (de 1000 à 4000 gauss soit de 2000 à 8000X celui de la Terre). Aussi, ne sont-elles pas immuables: elles naissent, elles évoluent puis elles meurent. En tirant les traits communs de l'évolution de nombreux groupes de taches, il a été possible de construire un schéma évolutif général des groupes de taches à la surface du Soleil (voir figure 1).

C'est dans le but fort légitime de connaître le stade d'évolution des groupes de taches que certaines personnes ont imaginé des classifications. L'une d'elles est basée sur la configuration des champs magnétiques à l'intérieur des groupes de taches. Evidemment, cette classification est inutile pour nous astronomes amateurs car il nous est impossible avec des moyens conventionnels de mesurer des champs magnétiques. Heureusement, il existe d'autres classification dont la classification de Zürich qui se base uniquement sur l'apparence visuelle du groupe de taches. La classification de Zürich attribue à chaque groupe de taches une lettre de A à J (I exclus) selon son degré d'évolution (voir figure 2). Les groupes de grande importance viennent à maturité en traversant les classes de A à F puis régressent lentement de F à J. Les groupes de plus petite importance ne peuvent traverser que quelques classes , par exemple ABCBA. Il faut noter que tous les groupes naissent et meurent en A. La classification de Zürich est donc très utile: elle permet de trouver rapidement et efficacement le stade de développement auquel est rendu un groupe de taches. Personnellement, elle m'a permis de retracer l'évolution des 20 groupes de taches qui furent à la surface du Soleil au cours du reportage.

Disons deux choses en terminant: premièrement, il serait sûrement très intéressant d'observer le Soleil avec d'autres filtres que le Solar Skreen. Des filtres ne laissant passer que la raie Hα ou les raies H et K du calcium nous permettraient d'étudier d'autres couches du Soleil. Il faut mentionner en second lieu que l'une des principales lacunes de ce reportage est qu'il ne couvre qu'une période de 11 jours. Pour pallier à ce défaut il faudrait effectuer un deuxième reportage couvrant cette fois une période d'un mois ou même d'une année. Etant donné la température peu clémente du Québec et de la majeure partie du Canada, ce projet demanderait une bonne dose de patience mais il représente très certainement un défi à relever.

Sylvain Veilleux

FIGURE 1.

EVOLUTION DES GROUPES DE TACHES SUR LE SOLEIL

1e jour: un groupe de taches naît toujours sous la forme de petites taches sans pénombre appelées pores. La majorité des groupes ne dépassent pas ce stade.

2e jour: la surface occupée par le groupe a augmenté, le groupe s'est allongé; les taches solaires se regroupent autour de deux taches principales, la tache de tête et la tache de queue.

3e jour: l'activité du groupe continue de croître, la tache de tête développe une pénombre.

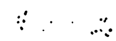
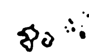
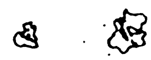
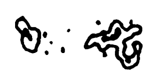
4e jour: une pénombre se développe aussi autour de la tache de queue, le nombre total de taches appartenant au groupe peut varier entre 20 et 50.

5e -12e jour: l'aire du groupe est à son maximum

13e -30e jour: les petites taches entre les deux taches principales disparaissent, puis la tache de queue disparaît en se fragmentant. Pendant ce temps, la tache de tête adopte une configuration circulaire.

30e -60e jour: la tache de tête diminue graduellement de taille et disparaît finalement. La tache de tête disparaît rarement en se fragmentant comme le fait la tache de queue.

CLASSIFICATION DE ZÜRICH

A	pore simple ou groupe de pores. aucune configuration bipolaire.		
B	groupe de pores. configuration bipolaire.		
C	groupe bipolaire. une des taches possède une pénombre.		
D	groupe bipolaire. les taches principales possèdent une pénombre. ϕ plus petit que 10° en l.h.		
E	groupe bipolaire. nombreuses petites taches entre les taches principales. ϕ plus grand que 10° en l.h.		
[illegible]	groupe bipolaire ou groupe complexe. ϕ plus grand que 15° en l.h.		
[illegible]	groupe bipolaire. aucune petite tache entre les taches principales. ϕ plus grand que 10° en l.h.		
[illegible]	tache unipolaire avec pénombre. ϕ plus grand que 2.5° en l.h.		
[illegible]	tache unipolaire avec pénombre. ϕ plus petit que 2.5° en l.h.		

THE ISLAMIC LUNAR CALENDAR

D.M. Stokes

inna indat-tashshura inda Allahi ashna-ashara shaharan (1)
.....the number of months, in the sight of Allah, is twelve months...

This revelation in the Arabic Qur'an established the new, Islamic calendar for the reckoning of time, and put an end to the practice of intercalating extra months. The rule until then had been to add a thirteenth month each 3rd, 6th, and 8th year of an eight year period to keep the solar and lunar calendars in synchrony. The purpose of this paper is to examine the theoretical basis for a lunar calendar and to review the Islamic calendar currently in use.

First, it is instructive to calculate the theoretical requirements for a perpetual lunar calendar taking the mean value of the synodic month as exactly 29.530589 days, or 29d 12h 44m 2.9s. A period of 12 months then corresponds to 354.367068 days, so that at the end of the first year there is a residue of 0.367068 days. At the end of the second year the calendar error has accumulated to twice this amount, or 0.734136 days. An extra day is then added and the error is reduced to 0.734136 -1.0 = -0.265864, with the negative sign indicating the adjusted calendar is now in advance. A computer program was written to signal the 'leap' years in which the calendar error exceeded 0.5 days, and to determine the residual error at the end of each year. The results are summarized in Table 1.

TABLE ONE

A CYCLE OF 30 ISLAMIC LUNAR YEARS (theoretical)

YEAR	TOTAL DAYS	RESIDUAL ERROR	YEAR	TOTAL DAYS	RESIDUAL ERROR
1	354	+.367068	15	5316	-.493980
2	709	-.265864	16	5670	-.126912
3	1063	+.101204	17	6024	+.240156
4	1417	+.468272	18	6379	-.392776
5	1772	-.164660	19	6733	-.025708
6	2126	+.202408	20	7087	+.341360
7	2481	-.430524	21	7442	-.291572
8	2835	-.063456	22	7796	+.075496
9	3189	+.303612	23	8150	+.442564
10	3544	-.329320	24	8505	-.190368
11	3898	+.037748	25	8859	+.176700
12	4252	+.404816	26	9214	-.456232
13	4607	-.228116	27	9568	-.089164
14	4961	+.138952	28	9922	+.277904
15	5316	-.493980	29	10277	-.355028
16	5670	-.126912	30	10631	+.012040

It is evident from Table 1 that at the end of a 30 year period the residual error will amount to less than 18 minutes (0.01204 days). If the computation is carried beyond 30 years, carrying forward the residual error, the pattern of 'leap' years is repeated only as far as the 57th year. Thus an almost perfect calendar would be obtained for a 30 year cycle equivalent to 10631 days, with a regular succession of 'leap' years obtained by adding one day at the end of years 2, 5, 7, 10, 13, 15, 18, 21, 24, 26 and 29 to make years with 355 days each; the common years 1, 3, 4, 6, etc., each having 354 days. The days in each month could alternate as shown in Table 2.

TABLE TWO

THE LUNAR MONTHS OF THE ISLAMIC YEAR

	NAME	DAYS	TOTAL	REMARKS
1	MUHARRAM	30	30	
2	SAFAR	29	59	
3	RABI'AL-AWWAL	30	89	or RABI' I
4	RABI'AL-THAANII	29	118	or RABI' II
5	JUMAADA-LAWWL	30	148	or JUMAADA I
6	JUMAADA-L AAKHIRA	29	177	or JUMAADA II
7	RAJAB	30	207	
8	SHA'BAAN	29	236	
9	RAMADAAN	30	266	month of fasting
10	SHAWWAAL	29	295	
11	DHU-L QA'DA	30	325	
12	DHU-L HIJJA	29 or	354	month of pilgrimage
		30	or 355	in 'leap' years

European chronologists have adopted this scheme in the past in order to create Tables of equivalent dates for the Islamic and Christian eras,(2) but these cannot be accurate, as we shall see.

That residual error we have ignored in adopting a 30-year cycle of exactly 10631days will accumulate to more than half a day after 1264 years have elapsed. Then, if one extra day is added the theoretical lunar calendar requires no further adjustment for nearly 2500 years!

While this provides the simple theoretical basis for a lunar calendar, in practice it is rather more complex. The Islamic month does not begin with the Astronomical time of new moon, but with the actual sighting of the lunar crescent in the sky at sunset. It is at sunset too that one Islamic day ends and another begins. Now, the earliest visibility of the crescent moon at sunset has received much attention, but the age of the moon at earliest visibility has not been well established.

It is thus very difficult for the calendar makers to anticipate on which day the new month will begin. This problem is compounded somewhat by the irregular but rythmic motions of the moon as we can see by examining the mean times of new moon, calculated on the basis of the mean synodic period, and the actuel, true times published in the Handbooks. Results of these computations are shown in Table 3. These times were computed with "Astronomical Formulae for Calculators", by Jean Meeus (3). The dates for new moon agree with the Observers Handbook to better than one minute (6)!

TABLE THREE

CONJUNCTION TIMES FOR THE NEW-MOON IN 1983

MEAN TIME OF PHASE				CORRECTION		TRUE TIME OF PHASE			
YEAR	DATE	HR	MIN.	HR	MIN.	DATE	HR	MIN.	LUNATION #
1983	JAN 14	4	10	+0	59	JAN 14	5	9	743
1983	FEB 12	16	54	+7	39	FEB 13	0	33	744
1983	MAR 14	5	38	+12	8	MAR 14	17	46	745
1983	APR 12	18	22	+13	38	APR 13	8		746
1983	MAY 12	7	6	+12	20	MAY 12	19	27	747
1983	JUN 10	19	50	+8	48	JUN 11	4	39	748
1983	JUL 10	8	34	+3	45	JUL 10	12	19	749
1983	AUG 8	21	18	-1	59	AUG 8	19	19	750
1983	SEP 7	10	2	-7	26	SEP 7	2	36	751
1983	OCT 6	22	46	-11	30	OCT 6	11	17	752
1983	NOV 5	11	31	-13	8	NOV 4	22	22	753
1983	DEC 5	0	15	-11	47	DEC 4	12	27	754

The dates and times of mean phase, in the first column of Table 3, are the basis for the theoretical lunar calendar, and are spaced evently through the year by intervals of 29.530589 days, the mean synodic period.

However, the motion of the moon around the Earth is strongly influenced by the Sun, so the relative position of the three bodies must be considered in order to properly account for the orbital speed of the Moon. Brown's Lunar Theory contains over 1500 terms to arrive at the exact correction, but the main aberrations can be estimated well enough for our purposes in 13 sine-terms which involve the mean anomaly of the Sun and Moon, and the Moon's arguement of latitude. These terms were computed, following the procedure of Jean Meeus, to arrive at the correction shown in the second column of Table 3.

It is apparent that the time of new-moon is retarded (correction positive) up to a maximum of 13hr 38m during the first part of 1983, and then advanced (correction negative) up to a maximum of 13hr 8m in the latter part of the year. Obviously these sinusoidal oscillations of the true time of new-moon about their mean will greatly affect the expected time of earliest visibility of the crescent after sunset. In effect, there are occasions when the new month will begin a day earlier than tabulated, and other times when it will be delayed by a whole day, compared to the theoretical calendar, most particularly when the 'correction' exceeds 12 hours.

This problem of the lunar calendar is certainly not new. The arabic astronomer al Biruni (died 441AH,1049CE) clearly recognized the variability of the times of new-moon. Many other arabic astronomers have discussed the difficulties in preparing a lunar calendar [5].

Never-the-less, a satisfactory lunar calendar could be prepared in advance if the time of earliest visibility could be accurately established. This was the subject of a paper in the December Journal, by Dr. Muhammad Ilyas [4]. This would require the co-operation of experienced observers everywhere, particularly those living between latitudes 0 to 10 North who are most favourably placed to first observe the new-moon at sunset. Dr. Ilyas proposed a criterion for predicting visibility of the new-moon based on the Moon's altitude at sunset and the angular separation of Sun and Moon. (Figures shown during the presentation are not reproduced here).

Dr Ilyas's criterion for lunar visibility shows that an observer near equatorial regions is more favourably placed than others. It is calculated that an observer at N10,W65 should see the crescent moon at sunset when the moon is only 18.1 hours old for lunation 748, and as early as 15.85 hours old for lunation 751. This criterion would appear to be rather optimistic, but further observation is required.

The Islamic lunar calendar was not actually put into use until it was agreed that the beginning of the Islamic era dates from 622 July 16. It is instructive to compute the time of new-moon closest to this date to see whether in fact this is possible, since of course the new era must have been dated from observation of the new-moon. Accordingly this computation was run on the computer, using the method of Meeus, and using the same equations as those used to compute the times of new moon for 1983. The program was paused to check that, for example, there was an eclipse in 1234 March 17, and to ensure that rounding errors were not accumulating too fast.

It was found that some 17 000 moons ago the time of mean phase was Julian Day 1948437.477, the correction was +0.2946 days and the true time of new-moon was JD 1948437.772. The data shows that there was certainly an eclipse of the sun that day, but it is not known whether this was visible in Saudi-Arabia! In a separate program, also based on Meeus, the Julian date was converted to the equivalent Julian calendar date, and found to be 622 July 14.272 (i.e. 06h 53m). Now the approximate time of sunset that day in Makka was about 19:00hr local time when the age of this new crescent was then about 9.5 hours. Thus the new-moon would not have been visible in Saudia Arabia until sunset on July 15th, which was a Thursday! This would make the first day of the first month of the first year (1 Muharram 1 AH) a Friday which is indeed a most appropiate time for the beginning of the Islamic era. And this day was in fact 622 July 16, without any ambiguity. The error in the

Julian calendar had accummulated to three days at that time so by modern reckoning the date should be 622 July 19. (i.e. by the Julian proleptic calendar). However, the Christian calendars of the time would have whown 622 July 16, Friday!

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Antonia Maury's Over-corrected Mass-ratio for Beta Lyrae.

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Abstract

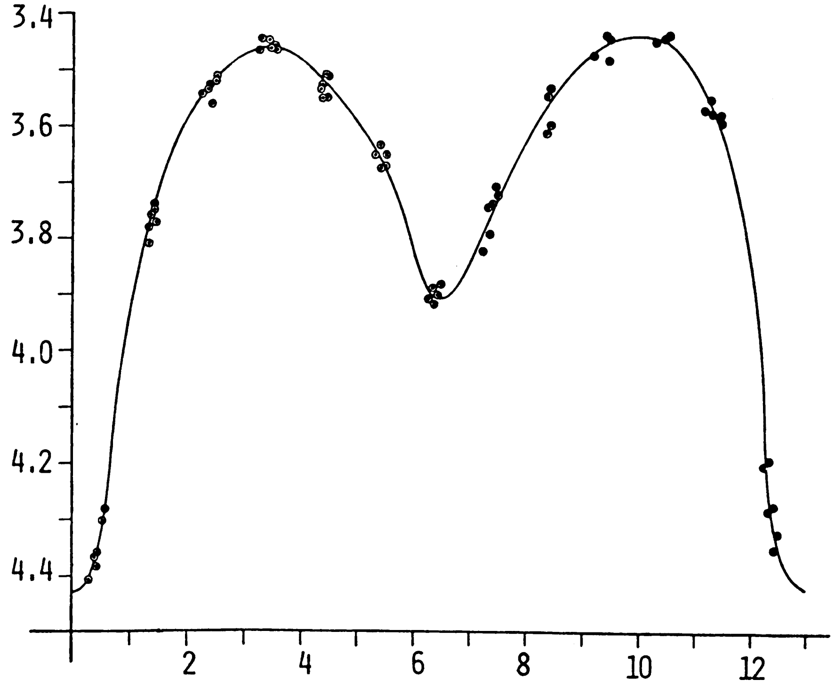
In the course of classifying stellar spectra photographed at Harvard College Observatory in the 1890s, Antonia Maury observed fascinating complex changes in the spectrograms of the peculiar binary star, Beta Lyrae. She monitored these spectral changes in the 1920s and published her analysis and interpretation of them in 1933. Unfortunately, her solution for the mass-ratio of the two binary components differed greatly from other published results and was quickly challenged by Struve. This paper will investigate the erroneous assumption Miss Maury made in deriving her solution and will speculate on what prompted her to make it.

* * * * *

Since Goodricke's discovery of the variability of Beta Lyrae in 1784, the general nature of its light curve has been well-established. In 1844 Argelander was the first to plot and publish a composite curve of observations by Goodricke, Heis and himself. Almost a century later Stratton published Baxandall's curve shown in Figure 1. In just under 13 days, the light variation produces a symmetrical sinusoidal curve of two equal maxima separated by two unequal minima. The shape indicates that the source is composed of a supergiant and an invisible companion revolving in a nearly circular orbit. Together with its velocity curves (Figure 2), the light curve shows that the primary minimum occurs when the bright star is eclipsed; the first maximum, when it is accelerating toward us; the secondary minimum, when the supergiant eclipses the invisible emission component; and the secondary maximum, when the bright star rapidly recedes. The range of the light variation is a magnitude from 4.4 to 3.4, and the range of the velocity curve is from about -200 km to +200 km.

Because Beta Lyrae comprises a bright B8 supergiant revolving around a massive but fainter B2 emission star, the resulting spectra taken throughout the 12.9-day period show both sharp absorption lines and bright emission lines. Other features such as emission bands shifting back and forth across

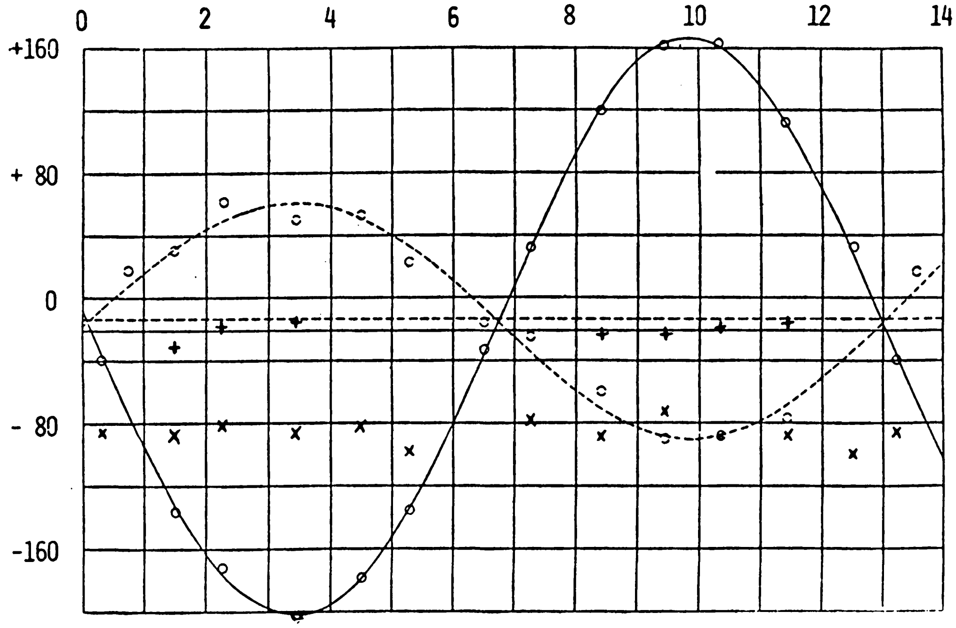
FIGURE 1. LIGHT CURVE OF β LYRAE.



the sharp absorption lines indicate that the stars are both elongated and rotate. These peculiarities set Beta Lyrae apart from most close binaries whose components have similar masses, luminosities, and spherical shapes.

In the 1890s several observers such as Tikhoff, Belopolsky, and Stein, carefully measured the displacements of the sharp absorption lines of the supergiant component to derive orbital elements for Beta Lyrae. In the 20th century first Curtiss then Rossiter measured additional spectrograms to confirm and refine the early values of the elements. The successively larger values for the period derived by each subsequent observer resulted from a real effect; the period has been increasing by 2/3 of a second per revolution or approximately 20 seconds per year. However, the successively smaller values for the eccentricity probably resulted from an observational effect. The significant values considered in this paper will be the orbital radial velocity, K, and the mass, M. For these elements the investigators derived consistent values between 180 and 200 km/sec and between 8 and 10 solar masses for the supergiant. From measurements of the bright emission bands of the invisible component they derived values between 75 and 90 km/sec (a little

FIGURE 2. VELOCITY CURVES OF β LYRAE.



o = SINGLE DARK LINES. ɔ = BRIGHT Hβ LINE. + = DARK REVERSAL, K, x = DARK REVERSAL, λ 5016.

less than half the value for the supergiant) and between 17 and 23 solar masses (a little more than twice the value for the bright star). Therefore, the work of the early investigators implied a mass-ratio of about 2/5.

One of the few graphical representations of the velocity curves of <u>both</u> components of Beta Lyrae is the plot by Curtiss shown in Figure 2. The solid curve connects measurements of single absorption lines of the supergiant and the dashed curve connects measurements of the H-beta emission line of the invisible component. The dashed horizontal axis indicates that the center of mass of the system is approaching us at approximately 21 km/sec. Again, these velocity curves, and hence the stellar masses, are in the ratio of 2 to 5. Of significance to this paper are the plusses and crosses that represent Curtiss' measurements of the dark reversals of the K line of Calcium and of lambda 5016 of helium, respectively. Antonia Maury made similar measurements and had a very difficult time rationalizing these blue-shifted lines with her model of the star.

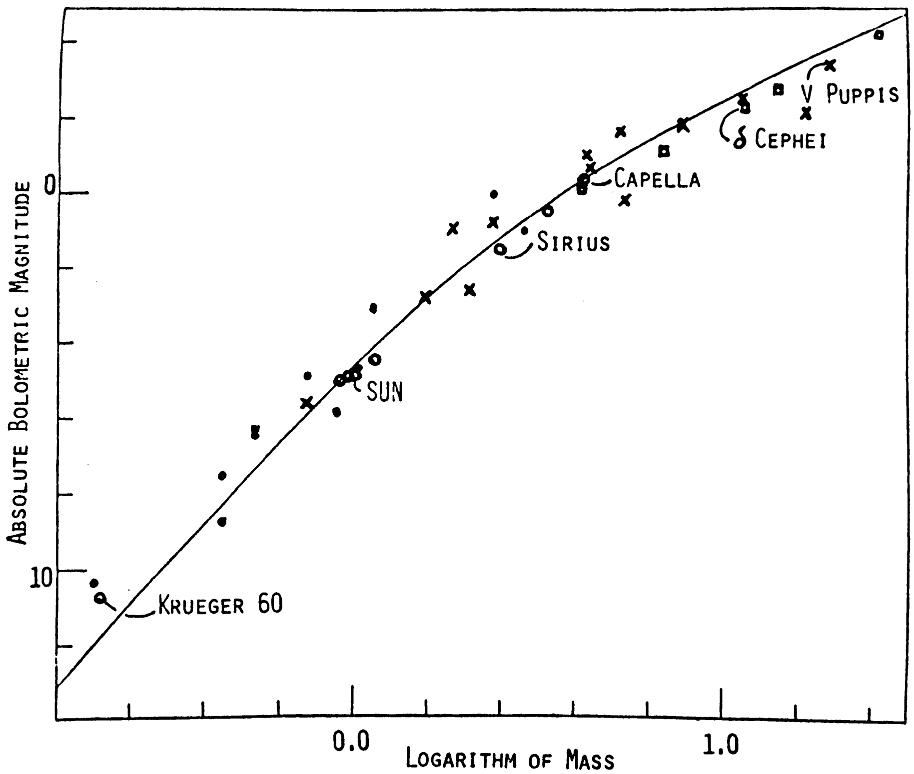
When she began to reduce her measures of Beta Lyrae, Miss Maury at once encountered the difficulty that each line gave a different velocity. She discovered that the blue shift Curtiss measured for the supergiant lines affected the lines of the emission star and implied a highly eccentric orbit. However, this implication directly contradicted the circular orbit indicated by the velocity curve. Therefore, since only the K line of calcium gave a circular orbit, Antonia Maury, unlike Curtiss and her other predecessors, subtracted the value of the K line from each of the lines of hydrogen and helium to correct for the blue shift. The displacements she derived for the chief lines of these elements are as follows:

Hydrogen Line	km/sec	Helium Line	km/sec
H_{beta}	-84	lambda 4471	-69
H_{gamma}	-57	lambda 4388	-66
H_{delta}	-33	lambda 4026	-22
$H_{epsilon}$	- 6		

Most of the basic elements of the relative orbit that Miss Maury determined and published for Beta Lyrae compare favorably with those of Curtiss and Rossiter. For her, the point of reducing the Harvard spectrograms of Beta Lyrae was not to determine orbital elements, but to rationalize the spectral complexities of the peculiar binary and to derive an astrophysical model of it. However, because Struve criticized her work on the basis of her erroneous mass-ratio for the star, we must look at her derivation of that fraction. The significant quantities are her values for the velocities, K1 and K2. As previously stated, the early investigators derived a value for the supergiant in the range of 180 to 200 km/sec, and for the dark emission star of 75 to 90 km/sec. Therefore, the accepted value of the sum of the velocities was in the range of 260 to 280 km/sec. However, Miss Maury derived 196 km/sec for the sum. Her low value results presumably because she "corrected" the velocities of the blue-shifted lines. Unfortunately, she then proceeded to adopt the value of 184 km/sec for the velocity of the supergiant.

Maury's Mass-ratio for Beta Lyrae.

FIGURE 3. EDDINGTON'S OBSERVATIONAL MASS-LUMINOSITY DIAGRAM.



This step implied a value of only 12 km/sec for the emission star. Therefore, Antonia Maury's final result was that the velocities, and thus the masses, had to be in the ratio of 1 to 15!

In criticizing Miss Maury's result, Otto Struve reasoned that if the mass of the bright star were equal to that of the sun, then the invisible component would be 15 solar masses. From Eddington's mass-luminosity relation shown in Figure 3, Struve deduced there would be a difference of 10 magnitudes in the bolometric brightness of the two stars. Yet, he knew that a difference of even one magnitude in the total brightness would be sufficient to extinguish completely all traces of the lines of the fainter star in the combined spectrum. Clearly, this was not true. Therefore, Struve concluded that Miss Maury's mass-ratio based on her "corrected" measurements of the radial velocities was not valid.

From her paper on "The Spectral Changes of Beta Lyrae" we know that Antonia Maury ostensibly wished to preserve the circularity of the binary star orbit and therefore corrected the measured velocities of the principal absorption lines to do so. It was an unprecedented step in the reduction of the velocity curve for the bright star of Beta Lyrae and effectively eliminated the velocity curve for the invisible component. Although she discussed these results in the first part of her paper, she may well have derived them at the end of her study. The real heart of her work on Beta Lyrae was based on her own astrophysical interests rather than the astronomical approach of her predecessors. In her paper she gave detailed discussions about the shapes of the absorption lines with respect to phase and included microphotometer graphs of spectrograms at various phases. Because she may have derived the orbital elements late in her study, she may not have given them the same careful thought that characterized her spectral classification of the 1890s and the spectrum analysis part of her study of Beta Lyrae. Finally, if she knew that Rossiter was about to publish his work on "The orbit and rotation of the brighter component of Beta Lyrae" in July, 1933, she may have rushed to complete her study in May of that year. Such pressure might have had the positive effect of insuring that she wrapped up her study, but also the negative effect of blinding her to analyzing an error that excluded her work from the bibliographies of subsequent investigators.

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OBSERVATORY ROW: SLIDING ROOFS FOR FUN AND PROFIT

by

David H. Levy

"Build an observatory? Me? With ten thumbs and a proven inability to turn a screwdriver? I haven't built a building since I was ten years old! Build an observatory? Never!" For two decades I had gone through life convinced that I could do without an observatory. And even my new 16 inch reflector was being designed for portability, however impractical that might be.

All that changed one sunny afternoon in November of 1980, when George Collenberg at the Flandrau Planetarium mentioned casually that he had a wooden sliding roof structure for sale. All I would have to do would be to move it, and in one day I'd have my own building. An offer I could hardly refuse! I'll never forget that first night with me and telescope surrounded by four walls. George's work was excellent; he had taken the time and care to build a comfortable and durable house. It survived to move without any problems.

How could I possibly have observed for two decades without a structure such as this? During the next week my observing hours were the most delightful I had known, the only problem being a slight tingling in my left hand. Lifting the heavy roof had been a greater challenge than I had expected and I must have done some nerve damage. But not enough to stop my appetite for more, and soon I took a close look at a tiny garden shed that had been rusting away behind my house. Could this be a candidate for a tiny fun observatory?

Converting this little building, whose dimensions were only 3 feet by 4 feet, presented no challenge. I settled on a large piece of plywood that would act as a hinged roof and with a gleaming white coat of new paint this little hut was ready for her telescope.

But what telescope? I tried a C-90 at first, but now, the roof lifts off to reveal an 80 mm f/5 refractor. I wonder if any other finder scopes are lucky enough to have their own personal observatory?

With these two as a start, I began to consider how, and if, I would go about creating an observatory for my 16-inch Dobsonian. Although I had designed the large telescope to be portable, so that it could be rolled out, the idea of engaging in such exercise at 4 a.m. before a predawn observing session struck me as awkward. I knew, also, that if the telescope could be set up within 5 minutes I would use it more often.

My decision came quickly one Sunday afternoon. I drove down the street and picked up a young high scholl friend named Dan Stowell.

"Hi, Danny! We're going into town!"

"What for?"

"I want to get some parts." We drove for almost half an hour, and as we entered the store Danny's curiosity finally got the better of him.

"Parts for what?"

"Oh, for the telescope."

"What telescope?"

"The 16-inch."

Danny's face turned ashen. "Oh Gosh, another observatory." It will take only a week to build." I said with a burst of optimism.

"Uh huh. Who, uh, do you suppose might help you?" Next morning a somewhat hesitant Dan Stowell joined me to begin work. And during the next 17 days the observatory slowly took shape despite a number of severe problems, the worst of which was a bad wind storm which knocked down three of the four walls in the third day.

My procedure of construction was patterned rather closely after the plan I used when I was ten; since that little house got finished I figured this one would too. Although I didn't waste any time with anything like plans or blueprints, I did base the structure around a metal garden shed, a plan which saved money but added to the time. Since these sheds are designed so that the roof supports the walls, my idea required large amounts of wood for extra bracing, both for the walls and for the moveable roof. If I were to build again, I most likely would use wood all around and forget the metal part.

Each of the 17 days would begin with a walk around the construction site during which I would make a mental note of the materials I might need for the day's work. Then I would go into town to buy supplies. One of the 4 X 4's set in concrete was not high enough, so I added some scraps of wood to make up the difference. This plan worked fine for Danny, who also did not get along with plans. And during the 17 days he learned all about walls, roofs and bad language. Our only disagreement concerned the kind of music by which we would build. I wanted classical but he enjoyed country, but since I also wanted to finish the work eventually, we compromised on two weeks of non-stop rock music. Even though the main construction phase ended by December 17, 1980, refinements and additions stretched out for more than a year, and this more relaxed secondary phase of construction was an exercise in good will that left the observatory station a monument to friendship. Judy Stowell designed the weather flaps for the roof. Leo Enright came down from Canada and helped me put in some hinged shelves, while Derald Nye helped install the telephone. Duane Niehaus helped with the roof and Rolf Meier and Mike Magee spent hours of their time installing the sound system. Other friends who added their valuable help were Eric Clinton, Roy Stowell and Jim Scotti. Mrs. Larson, the neighbor, provided cookies.

The three observatories have added a new dimension to my observing, of which comfort is only one aspect. The structures also help to keep observing conditions more constant, so that availability of chairs, note paper and even red lights always is the same, resulting in more consistent observations. The carpet keeps the dust level down and the walls reduce the dew on the rare nights that is the problem. Although I did not design the large building for more than one telescope plus observer, it does work reasonably well at star parties.

Because of its rather small size, the 16-inch telescope observatory has a set of hinged shelves that can hold atlases while in one mode, and act as light baffles in another. When the county installed a bright sodium light half a mile away last September, I responded by designing a large light baffle that mounts on the roof and lifts into place by a pulley system. And the telescope is positioned inside so that I get a good view of the lower eastern sky, where I do my predawn observing.

Perhaps the most useful advantage is more difficult to pinpoint, for it lies in a feeling that I did not have to the same extent before. Each observing session begins with a walk from house to observatory followed by a procedure of unflapping flaps and unhooking hooks. When all is ready the roof slowly slides backwards to usher in a sky filled with a thousand delights. And when the telescope rears its proud head to the stars, another night of observation, discovery, and thought is about to begin.

Remarques	Remarks
Parmi ceux qui n'ont pas fourni de manuscrit de leur conférence, il y en a qui ont déjà publié des articles en rapport avec le même sujet. Lorsque connues de l'éditeur, ces références sont fournies ci-après pour de plus amples lectures.	Among those who have not provided a written copy of their talk, some of them have already published related papers elsewhere. When known to the editor, he has added them in the following list of references for further readings.

Clifford Cunningham

- "Photoelectric Photometry of 2 Pallas", Journal RASC, Vol. 77, no 3,June 1983.
- "The Dance Hill Observatory", IAPPP Communication no 8, June 1982. Mr Murray Kaitting was coauthor.

Marc A. Gélinas

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Réal Manseau

- "Le théodolite", NNL RASC, Vol. 76, no 3, Juin 1982.
- "Le temps: La mesure de l'astronomie", NNL RASC, Vol. 73, no 6, Décembre 1979.

Jack Newton

- "Another Newton Observatory!", NNL RASC, Vol. 77, no 3, June 1983.

Paul Darisse

- "L'Observatoire de Québec", M. Darisse a accumulé un dossier impressionnant sur ce sujet. Nous espérons que 1984 verra le résultat de ses recherches enfin publié.