

The Cedar Post

February 1996

No. 27

The CEDAR Optical Tomographic Imaging Facility (COTIF)

Joshua Semeter and Michael Mendillo Boston University Center for Space Physics

The first three letters of the CEDAR acronym (Coupling, Energetics and Dynamics) describe inherently altitude dependent processes. Upward coupling from the troposphere, stratosphere and mesosphere, downward coupling from the magnetosphere, as well as internal dynamics within a given region, are now all areas of active research within the CEDAR community. Altitude information on plasma species needed for such studies is gathered by line-of-sight radar methods (most notably ISR and HF backscatter radars). In the case of optical methods, direct sensing of the atmosphere's altitude structure has been limited to LIDAR probing of trace species in the lower mesosphere (e.g., in the Na layer). Sounding rocket techniques have been used to probe emission profiles over a much

larger range, but these are infrequent and expensive.

Tomography has recently emerged as an important technique for exploring the spatial dependence of upper atmospheric features. Measurements made by the CEDAR community are often line-of-sight integrated quantities, such as the brightness (in Rayleighs) of an optical emission or the total electron content (TEC) from a satellite radio beacon. When these measurements are made from many different positions and angles, the intrinsic volume element can be recovered by numerically solving a set of integral equations (as in medical tomography). In the two cases above, the recovered quantity is the photon volume production rate $\varepsilon(lat, h)$ and the

electron density $N_e(lat, h)$, respectively.

Large scale tomographic imaging of the Earth's radiative environment are the goals of current satellite programs (ODIN, TERRIERS). These projects are aimed at reconstructing auroral arcs, the auroral oval, as well as global images of the Earth's ionosphere. Localized reconstruction of ionospheric electron densities has been demonstrated using a series of coaligned satellite radio beacon receivers. This technique has been used to study ambient ionospheric features, such as the main trough, and will be applied to the study of plasma irregularities in the future.

The CEDAR Optical Tomographic Imaging Facility (COTIF) has been designed to demonstrate the capabilities of ground-based atmospheric emission tomography. In its present form, COTIF consists of (continued on pg. 3)

In This Issue: Page COTIF...... 1 1996 Workshop Requests 3 MSX/CEDAR Update..... 4 AGU Special Session 4 FY97 CEDAR Competition 4 5 Poster Presentations HLPS Workshop 6 CEDAR Workshop Videotapes.. 6 Grad Student Fellowships 7 CEDAR Statistics 7 Travel Grants/Per Diems 8 Prize Lecture Nominations 8 1996 Annual CEDAR Meeting Plans 9 CEDAR Workshop Agenda... 10,11 Boulder Lodging 12 1996 Eleventh Summer Workshop - Registration 13 Student Financial Support .. 14 Housing Application 15 Interim Review/Back Issues 16



COTIF continued

three meridional imaging spectrographs along with the CEDAR Class-1 imager at Millstone Hill. The instruments have been placed in a line extending from Caribou, Maine, to Block Island, Rhode Island (see top of page 2). COTIF measurements are used in conjunction with regularized tomographic inversion algorithms to produce 2D (latitude vs. altitude) volume production profiles of optically thin emissions.

The COTIF approach contrasts with radio beacon and space-based tomography in several important ways. First, there is no satellite involvement. This allows for continuous monitoring of emissions over a long period of time. A geomagnetic event can be studied without a coincidental satellite overpass. However, the latitude coverage is confined to less than 8 degrees. Second, COTIF records multiple wavelengths simultaneously, an advantage when studying processes that lead to multiple emissions. Third, the system is reasonably portable, requiring at most 4 sites with power. The major disadvantage of COTIF is weather, in that clear skies above at least 2 sites are required to retrieve any spatial information.

The COTIF technique can contribute to many fundamental issues in optical aeronomy. At high latitudes, determining the altitude dependence of auroral emissions will facilitate modeling studies of particle precipitation patterns and energies. At its present mid-latitude location, tomographic inversion of stable auroral red (SAR) arcs will help resolve issues regarding source mechanisms and improve our understanding of ionospheric coupling to ring current processes. Tomography at mid-latitudes also can provide long term monitoring of the extent and structure of the main ionospheric trough via airglow signatures. Near the equator, tomography of airglow gradients will advance our understanding of the seeding process for Rayleigh-Taylor instabilities that create spread-F plumes. Tomographic imaging can also be used to resolve the altitude of the peaks and troughs of atmospheric gravity waves at all latitudes.

Figures, opposite page

COTIF presently consists of 3 meridional imaging spectrographs and the Millstone Hill all-sky camera. The instruments lie approximately along a great circle that cuts through the mid-latitude ionospheric trough, as shown in the top panel. The lower panel illustrates schematically a tomographic reconstruction geometry appropriate for Fregion structures. In addition to tomography, a COTIF data set can be used to define other interesting problems in inverse theory. For example, if an ambient airglow layer is assumed to be thin (e.g. Na or OH emissions), then one might be interested in determining the emission altitude as a function of latitude. Multiple observations of a chemical release effect may be used to determine the centroid of emission, in lieu of a full tomography problem. Reconstructions of these sorts can be combined with other quantities derived from the same physical process. For example, OH observations may be used to construct a temperature vs. altitude map; a chemical release effect may be used to uncover an altitude dependent reaction rate.

The altitude emission profiles of photo-chemical processes are as basic to our understanding of aeronomy as electron density profiles to the ionosphere, and yet we are more than 50 years behind in direct sensing of this fundamental information. COTIF has recently begun to explore these techniques through actual field tests, and a set of promising results has been obtained. The application of tomographic techniques to studies of the upper atmosphere will have a significant impact on aeronomy.

1996 Workshop Requests

If you wish to host a workshop at the 1996 CEDAR Workshop, **please send notification** to Cassandra Fesen (fesen@tides.dartmouth.edu) **before April 1**. A list of the workshops and times will be in the May CEDAR Post. Please identify the workshop type as *planning*, *working* group, or mature with results and interpretation. Workshop leaders are expected to introduce both students and non-students, and to provide an overview at the beginning of the workshop and a summary at the end in order to give students a perspective. A quarter-page summary of each workshop will be printed in the September CEDAR Post to provide closure.

Cassandra Fesen, Dartmouth College

MSX/CEDAR UPDATE: OPPORTUNITIES FOR COLLABORATIVE MEASUREMENTS

The Midcourse Space Experiment (MSX) observatory is a BMDO project which will offer major opportunities for detailed investigations of the composition and dynamics of the Earth's middle and upper atmosphere. The spacecraft features an advanced set of multi-spectral imagers capable of gathering data on atmospheric phenomena in the limb, nadir or pointing mode. MSX will be launched into a high inclination, sun synchronous orbit with a 4 pm ascending node. The operational lifetime of the cryogenic instruments (mainly for infrared observations) is expected to be ~15 months but the satellite lifetime for UV, visible and other instruments is anticipated to be ~5 years.

MSX launch is now scheduled for April, 1996 from Vandenberg AFB, California. Measurements of visible optical and infrared atmospheric emissions at altitudes from 10 to 150 km are planned at auroral, mid- and equatorial latitudes in conjunction with ground sites instrumented to monitor atmospheric temperature, density, wave phenomena, emission rates, electron density and other parameters. Full scale operations are anticipated from June 1996 onwards.

An MSX workshop will be held at the June '96 CEDAR meeting (coordinated by G. Romick, APL; R. O'Neil, PL; and M. J. Taylor, USU) at which a detailed report of the satellite status and current MSX mission operations will be given together with some first-look, spectral/imager measurements. A key element of this workshop will include detailed planning and logistics for the coordinated auroral, nightglow and twilight measurements. **CEDAR investigators interested in collaborative measurements with MSX should contact Mike Taylor, Utah State University (see below) regarding their measurements plans as soon as possible.** Further information concerning this collaborative opportunity and the MSX launch status will be circulated as it becomes available via the CEDAR e-mailing list.

M. J. Taylor (MSX/CEDAR Coordinator) e-mail: Taylor@psi.sci.sdl.usu.edu

SA2 Thermospheric and Mesospheric Studies Using Combined Radio and Optical Techniques

Special session for Spring 1996 AGU meeting

We are soliciting results obtained from the combined usage of radio and optical measurements for the study of the structure and dynamics of the mesosphere and thermosphere. In addition, papers dealing with the computation of the atomic oxygen ion-neutral collision frequency from such observations and other techniques, as well as from theoretical calculations and laboratory measurements, are invited in order to assess this key parameter in ionosphere-thermosphere coupling studies. (This session will be held in memory of Roger Burnside who pioneered some of the early studies of the thermosphere using combined radar and optical measurements.)

Convenors:

Richard A. Behnke National Science Foundation, 4201 Wilson Boulevard Arlington, VA 22230 (rbehnke@nsf.gov)

Joseph E. Salah MIT Haystack Observatory Route 40 Westford, MA 01886 (jsalah@mit.edu)

FY97 CEDAR Competition

The deadline for submission of proposals for CEDAR funding in FY97 is May 1, 1996. This round of CEDAR competitions will also include proposals for CEDAR post-doctoral positions. NSF will issue an official announcement describing the scope of the CEDAR competition and special requirements for postdoctoral applicants. A description of the CEDAR program can be found in NSF publication NSF95-45, The U.S. Global Change Research Report. Please consult the NSF Grant Proposal Guide (NSF95-27) for information on proposal preparation and submission.

GUIDELINES FOR POSTER PRESENTATION

Each year at the CEDAR meeting, students present papers in a poster format. These poster presentations are an integral part of the CEDAR meeting; unlike AGU, no other sessions are scheduled to conflict with the poster session. For the last several years we have had 70 or more posters presented in two separate sessions during the meeting. These sessions are well attended and permit ample time for the students to show their work and to interact personally with experienced scientists as well as other students. (Poster space is 4 feet tall by 3.5 feet wide.)

The poster presentation is a culmination of many weeks of effort by the student prior to the meeting. To acknowledge the efforts made by all the students and encourage the students in their research endeavors, posters are judged to determine the best student paper of the meeting. The judging process also helps students recognize the importance of poster preparation and presentation and, in a way, prepares them for the peer review process they will experience as independent researchers.

The posters are judged based on four equal criteria:

- 1) Scientific content
- 2) Knowledge of the subject
- 3) Relevance to the CEDAR program
- 4) Clarity of presentation (i.e. organization, interpretation, etc.)

Over the past three years, the student designated as the CEDAR student representative for the year has been one who placed among the poster prize winners. The duties of the student representative include participating in the CEDAR Science Steering Committee meetings and organizing the student CEDAR workshop for the annual summer CEDAR/NSF conference. This is valuable experience to prepare oneself for the future and to see how CEDAR and the NSF function. The CEDAR Science Steering Committee strongly encourages student participation in the poster sessions.

For the 1996 CEDAR meeting, all 70 or more posters will be presented in the large Glen Miller Ballroom in the University Memorial Center (UMC) on Tuesday, June 18, between 3:00 and 6:00/7:00 PM. Presenters will put up their posters between 2:00 and 3:00 and take them down before they go to dinner. A reception is planned from 3:00-6:00 PM during the poster session.

This year, Dr. John Sahr will be the organizer for poster presentations. Please submit an abstract to him (as described below) by TUESDAY MAY 28 (after the AGU). If your presentation requires special equipment (such as TV/VCR), please be sure to indicate your needs. If too many posters are submitted for our available venues, preference will be given to students' efforts and to those with a single entry, although this is not expected to be a problem this year. You may also wish to check the following WWW site for updated information: http://isdl.ee.washington.edu/SPP/CEDAR/CEDAR.html

Abstracts may be submitted to John Sahr in the following ways: email (**preferred**): plain text to jdsahr@ee.washington.edu surface mail:

Dr. John Sahr University of Washington Electrical Engineering Box 352500 Seattle WA 98195-2500

FAX: 206-543-3842

Submitted by Jeff Thayer and John Sahr

HLPS Workshop

The CEDAR-High Latitude Plasma Structures (HLPS) working group will host a half-day workshop during the CEDAR meeting in June 1996. Note: A return to Peaceful Valley is being considered for 1997. During the past year the debate over a patch definition has heated up and progress is being made towards identifying and quantifying the differences between instrument techniques used to study patches. At least four distinct techniques are commonly used; groundbased optical emission measurements, ISR and ionosonde sounding, satellite in-situ plasma sensors, and most recently the HF radar (i.e., SUPERDARN) observations of plasma irregularities associated with the patches. Confusing this situation further is the theoreticians' use of the "tongue of ionization" to simplify polar cap modeling. This phenomena has a long observational history but also lacks a common definition. We encourage presentations that address these issues, not only the instrumental aspects but also the physics. For example, what is the role of the thermosphere----is it passive? or do internal gravity waves at F-region altitudes cause "patching"?

The high latitude is currently being observed with great capability and more is planned. The prelude to a full Polar Cap Observatory (PCO) has happened with extensive optical observations from Resolute Bay, the site of PCO. In Europe and in conjunction with Japan, EISCAT is extending its facilities into the cusp and poleward edge of the oval. With a PCO-ISR being proposed, the possibility for studying the entire polar cap will become a reality. Issues of convection, precipitation, neutral winds, gravity waves, etc. on this 2-D scale will for the first time be amenable to observation and study. However, the daunting task of combining these extensive data sets will have to be faced. We encourage discussion and presentations of how campaigns, and more specifically, analysis of these data sets will be accomplished. Topics associated with sunaligned arcs, traveling twin vortices, gravity waves, irregularities and patches are all relevant.

With the international STEP community moving into its next phase, STEP-RAMP (Research Analysis Modeling Phase), we look forward to continued participation of our international GAPS (Global Aspects of Plasma Structures) colleagues.

> HLPS Co-chairmen J. J. Sojka (Utah State University) E. Weber (Phillips Laboratory)

1995 CEDAR Workshop Video Tapes Available

The videos for the 1995 CEDAR Workshop are complete and are on 3 tapes as follows:

1) Tutorial #2

- a) Testing theories of gravity wave saturation and dissipation in the middle atmosphere by Chet Gardner, University of Illinois (33 min)
- b) Testing theories of gravity wave transports and their effects on wind, temperature and composition

by Richard Walterscheid, Aerospace Corp. (32 min)

and

CEDAR Prize Lecture: Modeling of Gravity Wave and Instability Processes in the Middle Atmosphere by David Fritts, University of Colorado

(38 min)

2) Tutorial #1

Global Change in the Mesosphere-Lower Thermosphere (MLT) Region: Has it already arrived? by Gary E. Thomas, University of Colorado (58 min) Tutorial #5 Ionospheric/Thermospheric Space Weather Issues

by R. W. Schunk & J. J. Sojka, Utah State U. (58 min)

3) Tutorial #3

Solar Wind/Magnetosphere Drivers of Space Weather by D. N. Baker, University of Colorado

(42 min) Tutorial #4

Comprehensive Modelling of the Middle and Upper Atmospheres by Kevin Hamilton, Geophysical Fluid Dynamics Laboratory/ NOAA, Princeton U.

(65 min)

This is the first year that we have included the questions after the presentations. Some questions were not audible, so they are written in the video.

The videos are \$50 for a set of 3 in NTSC format (USA, Canada, etc.), and are \$80 for PAL (most of Europe) or SECAM (France, etc.). Single tapes run \$25 each for NTSC format, and only come in the above order.

If you wish to get a copy of the tapes, or a free copy of the notes, please contact Dr. Barbara Emery at the address listed on the registration form.

Graduate Student Fellowships to Work with the CEDAR Data Base

Again this year, two graduate students will have the opportunity to work intensively with the CEDAR Data Base around the time of the 1996 CEDAR Workshop. We anticipate that they would arrive before the meeting on Sunday, June 9, and would work on workstations with Data Base personnel before the Workshop, and attend the Workshop the following week. Recipients will have their dorm rooms paid for the entire time, and will receive an extra \$26/day for the extra time they are in Boulder. The NCAR shuttle service can get them from campus to Foothills or the Mesa Lab. Only students with some significant Data Base project will be considered, and students will be chosen from different institutions in order to spread their knowledge around. A sample application form follows. Please include this information in your application. The selection committee will consist of some members of the CEDAR Steering Committee, and some members of the CEDAR Data Base. Applications are due in by April 30, and the selection will be made by May 10. Applications can be mailed, FAXed, or e-mailed to Dr. Barbara Emery at the address listed in the registration form. If e-mailed, the advisor approval and statement of support can be sent in separately via e-mail or otherwise.

Sample Application to Use the CEDAR Data Base June 10-14, 1996

Name: Institution Address: e-mail: Graduate Advisor: Expected degree and date of graduation: Expected CEDAR Data Base project: (i.e., Need data from instruments or models ... Need to select parameters ... Project about Expected benefits) Advisor approval and statement of support:

CEDAR Workshops show undergraduate participation between the 8 16% level from								
1988 to populat	1988 to 1995, while Master's candidates have been between 16-22% of the total student population since statistics were gathered in 1990.							
Statistics on CEDAR Workshops B. Emery - 10/19/95								
	u=undergraduate, M=Masters candidate, P=PhD candidate							
#	Year	#Participants	#Students	23 	#Univ(non-US)	#Res(non-US)		
1	1986	~61	~0+?local					
2	1987	160	19 (0u)+?lo	ocal				
3	1988	~180	39 (3u)					
4	1989	221	68 (7u)					
5	1990	267	106 (12u 17)	M 68P)				
6	1991	254	116 (15u 23)	M 78P)				
7	1992	283	131 (17u 29)	M 85P)				
8	1993	397	174 (15u 33)	M 126P)				
9	1994	347	155 (18u 28)	M 109P)	37 (6)	34 (7)		
10	1995	315	141 (22u 27)	M 92P)	40(7)	33 (9)		
					2 ⁴ 1623			

Graduate Students and Travel Grants for CEDAR 1996

All students from US or foreign institutions who attend the CEDAR meeting will have their registration fees waived. A list of students, their interests and graduation dates will be distributed at the meeting. A bulletin board will be provided for job or other announcements. Jobs announced via the CEDAR e-mail list are posted on the WWW site: http://www.hao.ucar.edu/public/research/tiso/cedar/ cedar.html Space is also available for resumes. Please send resumes to Barbara Emery at emery@ncar.ucar.edu. Students will be introduced via institution during the first plenary session on Monday morning.

NSF has provided money for travel for students from US institutions or students from foreign universities who will be visiting a US institution during the summer and so will have a US sponsor. All non-local students, including all foreign students, will receive a small per diem (or a double dorm room) to help defray local costs. Preference will be given to graduate students, but involved undergraduates are also welcome.

Applications for travel funds must be received by APRIL 15!

The "Application for Student Financial Support" requires the signature of the research advisor. (The form can be e-mailed if your advisor sends in a separate e-mail confirmation). ALL students should fill out the form in order to be included on the list of students, their interests and their advisors, which will be available at the meeting. Please send these forms to Dr. Barbara Emery at the address shown on the registration form. Please include an e-mail address, if possible, since many announcements will be sent via e-mail only.

Professional Travel in Denver will make airline reservations for students travelling from cities where the government rate to Denver is cheaper than the early reservation, Saturday night stayover rate. These cities are: Albuquerque, Baltimore, Chicago, Dallas, Dayton, Detroit, Houston, Huntsville, Los Angeles, Miami, Newark, Orlando (for those from Daytona Beach), Pittsburgh, Reno, Salt Lake City (for those from Logan), San Juan (for those from Arecibo), Tucson, and Washington DC National. If you are flying from one of these cities, contact the Groups Department of Professional Travel at (800) 333-6338 (not available in Alaska), or (303) 706-0570 (FAX: (303) 706-0575 to make airline reservations <u>AFTER May 1</u>.

Students travelling from other cities are responsible for getting their own tickets for a Saturday night stayover

Nominations Requested for the 1996 CEDAR Prize Lecture

The CEDAR Prize Lecture was established in 1989 to recognize outstanding scientific contributions to the CEDAR Program. Selection is based upon a research paper either presented, submitted, or published during the past year. The candidate will present a special 30-minute lecture at the 1995 CEDAR Meeting. Previous CEDAR prize lecturers are:

1989 - Art Richmond, Assimilative Mapping of Ionospheric Electrodynamics

- 1990 Michael Mendillo, The Discovery of a Sodium Magneto-Nebula around Jupiter
- 1991 Craig Heinselman, Sondrestrom MUSCOX Capabilities and New Results
- 1992 Colin Hines, The Doppler Spreading Theory of Gravity Wave Spectra
- 1993 John Cho, Radar Scattering from the Coldest Place in Our Atmosphere: Polar Mesosphere Summer Echoes
- 1994 Raymond Roble, Modeling the Circulation, Temperature, and Compositional Structure of the Upper Atmosphere (30-500 Km)
- 1995 David Fritts, Modelling of Gravity Wave and Instability Processes in the Middle Atmosphere

Nominations for this year should be submitted by April 1 to:

Dr. Jeffrey Forbes Department of Aerospace Engineering Sciences University of Colorado Boulder, CO 80309-0429 Phone: (303) 492-4359; Fax: (303) 492-7881 e-mail: forbes@zeke.colorado.edu

Travel Grants continued

1996 Annual CEDAR Meeting Plans Sunday, June Do Saturday, June 22, 1996 University of Colorado, Boulder, CO

16

The Sunday session is a student workshop that is scheduled to go from about 1:30-5:30 PM the first day of the workshop. Registration packets will be delivered to the dorms, but will otherwise be available at Math-100 in the mornings from Monday through Saturday. Parking permits are necessary during the week days, and can be purchased for \$15/ week or \$3.75/day from the campus police, located next to Lot 436. (This lot is east of the Engineering Building). Permits should be purchased right away since tickets can appear within 5-10 minutes of a car being parked Monday-Friday. Students can request a permit on their Application for Student Funding Support form and pick it up at Kittredge Commons.

Workshops will be held in the Engineering Building in the afternoons except for Tuesday, when there will be a single large poster session at the University Memorial Center (UMC), along with a reception. The Saturday session is a joint CEDAR/GEM session that is being planned by a joint committee. The buffet will be held on Wednesday, June 19 on the Tree Plaza of the NCAR Mesa Lab. Buses will be provided. Any alcohol at the reception and the buffet will come from voluntary contributions sent in with the registration form. (We were a bit short last year, so, please, consider a contribution). The extracurricular activity this year is dinner and the play "My Fair Lady" at the Boulder Dinner Theatre on Thursday, June 20.

Barbara Emery

DEADLINE:

CEDAR post-doc applications

May 1, 1996

and will be reimbursed after the workshop. If you must stay over a Saturday night, Professional Travel can get your tickets if you do not want to, but we would like you to pay for them if you cancel. Government tickets can be cancelled with no penalty.

Cities where the Saturday night stayover rate is within \$40 of the government rate can choose either service. These cities are: Champaign, Fairbanks (unless cheap Saturday night deals are available), New York JFK, and Seattle. If you find a cheaper Saturday night fare than the one listed in a future letter to students, NCAR will pocket the difference to spend on other things. For undergraduates who are coming from their home cities, PLEASE contact Professional Travel to see if they can get you a good deal on the air fare.

Students are not REQUIRED to stay the whole period, and Saturday night stayover tickets can be altered for about \$50, which students would be expected to pay. However, the dormitory package is from Sunday night through Thursday night, with possible extensions of time at the beginning and end. Hence, if you plan to come for only part or none of the package time, stay at a hotel instead. Students who drive will receive \$0.30/mile or the equivalent air fare listed in the student letter, whichever is smaller. The per diem (which includes meals, lodging, airport shuttle and miscellaneous) is \$25.50 per day, or \$204 for 8 nights stayover.

The only dorm this year is Kittredge Commons (not airconditioned), with adult rather than youth service. This includes maid service every day and a somewhat better cafeteria selection. However, the price for a single room is almost twice that of a double. Therefore, students who stay in a double room at the dormitory will have their dormitory fees paid by NCAR in lieu of the per diem. All students in single rooms at the dorm and those at hotels will pay their own lodging fees, and be reimbursed \$25.50/ day after the meeting. (This per diem does not really cover meal costs or anything other than a double room at the dorm, but some advisors can help make up the difference.)

ALL students must make their own lodging arrangements, but those who stay in the dorm will be able to pick up their registration packets at check-in. Those students who need a parking permit must request them on the Application for Student Financial Support, and can then pick them up at Kittredge Commons (probably Sunday evening) even if they are not staying at the dorm.

1996 CEDAR Workshop Agenda University of Colorado June 16-22, 1996

Note: This is a draft agenda.

Registration packets are available upon check-in at Kittredge Commons dorm or in the mornings Monday-Saturday outside Math 100. Workshops are in the Engineering Building, and the Poster Session/Reception is at the University Memorial Center (UMC). Plan to have IS/Facilities posters on display Monday-Wednesday in Math100 or Engineering Building, and Satellite posters on display Thursday-Saturday.

Tutorial Speakers:

Tues. or Thurs.: Bela Fejer, Utah State University (ionosphere)

Tues. or Thurs.: TBD (MF/UARS/IS discrepancies, etc.?)

Friday: Richard Wolf, Rice University (magnetospheric models and their relationship to the ionosphere and space weather)

Sunday, June 16

01:30-05:30 - Student Workshop at Math-100 or Eng CR0-30 or LASP

Monday, June 17 (Math 100 AM, Eng Bldg PM)

08:30-09:30 - Math 100, Welcome/Introductions Jeff Forbes/Michael Mendillo, NCAR
08:30-09:00 - NSF Welcome/Comments Sunanda Basu, Bob Robinson, Rich Behnke
09:00-09:30 - CSC Comments, Introductions of Post-docs, students Mendillo
09:30-10:00 - Phase III, Part 1/5
10:00-10:30 - Break
10:30-11:00 - Phase III, Part 2/5
11:00-11:30 - CEDAR Prize Lecture
11:30-12:00 - TBD or left free for spontaneous meetings
12:00-01:30 - Lunch
01:30-05:30 - Workshops in the Engineering Bldg (Break starts ~3:30)

Tuesday, June 18 (Math 100 AM, UMC Ballroom PM Posters/Reception)

08:30-09:00 - Math 100, Phase III, Part 3/5 09:00-09:30 - Phase III, Part 4/5 09:30-10:00 - CEDAR Post-doc reports: Susan Nossal, 2nd year, 20 min Yuri Taranenko, 1st year, 10 min 10:00-10:15 - Break 10:15-11:15 - Tutorial #1 - TBD 11:15-03:00 - Free time for spontaneous meetings (Contact Barbara Emery to reserve Engineering Building rooms or Hallet Hall Lounge.) 03:00-06:00 - Poster Session at UMC Glen Miller Ballroom (Set up posters between 2-3 PM, and take them down before going to dinner.) Reception during poster session

Note: This is a draft agenda.

Wednesday, June 19 (Math 100 AM, Eng Bldg late AM and PM)

08:30-09:00 - Math 100, Phase III, part 5/5

09:00-10:00 - 4 CEDAR Science Highlights of 15 min each

10:00-10:15 - Break

10:15-12:30 - Workshops in the Engineering Building

12:30-01:30 - Lunch

01:30-05:30 - Workshops in the Engineering Bldg (Break starts ~3:30)

06:30-08:30 - Bar-B-Q on the Tree Plaza at the NCAR Mesa

Thursday, June 20 (Math 100 AM, Eng Bldg PM)

08:30-09:00 - Math 100, Facilities Reviews, New Technology Awards, NSF, Bob Robinson 09:00-10:00 - Tutorial #2 - TBD 10:00-10:15 - Break 10:15-11:15 - TIMED 11:15-12:00 - TBD or left free for spontaneous meetings 12:00-01:30 - Lunch 01:30-05:30 - Workshops in the Engineering Bldg (Break starts ~3:30)

Friday, June 21 (Math 100 AM, Eng Bldg PM, may be of interest to GEM)

08:30-09:00 - Math 100, Student poster awards
09:00-09:30 - Space Weather, Rich Behnke, NSF
09:30-10:00 - Report on GEM program, TBD
10:00-10:15 - Break
10:15-11:15 - Tutorial #3 - Richard Wolf, Rice University, Magnetospheric models and their relationship to the ionosphere and space weather)
11:15-11:45 - ?? NASA Update ??
12:00-01:30 - Lunch
01:30-05:30 - Workshops in the Engineering Bldg (Break starts ~3:30)

Saturday, June 22 (with GEM)

08:30-05:30 - Math 100 and Eng Bldg, TBD with breaks ~10:00 and ~3:30

Boulder Lodging and Local Transportation Information

1996 Summer NSF CEDAR Workshop

June 16-22, 1996

The facilities listed below have blocked rooms for workshop participants between the nights of June 14-22, 1996. Reservations must be accompanied by a credit card charge number or a deposit for the first night's lodging; Visa, MasterCard, American Express, and Discover credit cards are accepted at most of the hotels. Cancellations must be made before 4:00 PM on the arrival day to avoid being charged for the first night's lodging. The blocks of rooms at special workshop rates are only being held until the dates indicated below and they may fill up early. MAKE ALL RESERVATIONS AS SOON AS POSSIBLE AND SPECIFICALLY MENTION THE CEDAR WORKSHOP HOSTED BY NCAR. (If using travel agents, have them identify you in the same manner.) Participating hotels and rates for June 14-22, 1996 are:

Hotel Days Inn 5397 South Boulder Road Boulder, CO 80303 (303) 499-4422; Fax (303) 494-0269	Single* \$74	Double* \$79	Deadline May 14	No. of Rooms 65
Holiday Inn of Boulder 800 - 28th Street Boulder, CO 80303 (303) 443-3322; Fax (303) 443-0397	\$75	\$75	May 16	35
The Broker Inn 555 30th Street Boulder, CO 80303 (303) 444-3330; Fax (303) 444-6444	~ \$72	~ \$82	May 14	30
Courtyard by Marriott 4710 Pearl East Circle Boulder, CO 80301 (303) 440-4700; Fax (303) 440-8975	\$99	\$109	May 17	30
Homewood Suites 4950 Baseline Road Boulder, CO 80303	\$129 for a Suite w/Kitchen (will accommodate 3-4 people)		May 14	5
(303) 499-9922 ; Fax (303) 499-6706	(Group Confirmation #815	559537)		

RESERVE ROOMS BEFORE DEADLINES TO ASSURE LOWER RATES

All hotels have comfortable accommodations and swimming pools. All of them, except the Courtyard, can provide shuttle service to local meetings if requested by individuals *in advance* (based on availability). Checkout times are 12:00 noon. *Hotel rates do not include 9.65% sales tax. ~ Government rates, subject to increase without further notice.

UNIVERSITY OF COLORADO DORMITORY ROOMS AND MEALS

Main Campus Conference Housing Area	Single	Double	No. of Rooms 25 (S), 75 (D)
142 Cheyenne-Arapaho Hall	\$223.73	\$126.78/per person	
Boulder, CO 80310 Fax: (303) 492-5959 e-mail: TBD (can set	end to Barbara E	mery)	

Rates for the dorm campus package include a dorm room for 5 nights from 6/16-6/20 (Sunday-Thursday) and breakfast every day Monday-Friday. Early arrivals or late departures will pay an extra \$38.38 for a singleand \$19.19 per person for a double. CU accepts VISA and MasterCard. Please check in at Kittredge Commons. Parking permits for a week can be obtained from campus police or requested by students via the Application for Student Funding. Students staying in a double room will not have to pay lodging upon arrival, but NCAR will pay this bill in lieu of their per diem. Students staying in a single room will have to pay for their lodging upon arrival, and will only be reimbursed about half of the cost after the meeting.

GROUND TRANSPORTATION (Airport). The Boulder Airporter Inc. (303-444-0808, \$14/one way, \$26/round trip) and the Rocky Mt. Supercoach (303-499-1951, \$19/one way, \$34/round trip) will take reservations for direct transportation between Denver International Airport, the hotels, and the University. Their schedules are staggered so you may find one more convenient for your arrival/departure.

DAY CARE. For child care while you attend the Workshop, Children's World at 5377 Manhattan Circle in Boulder will accept children on a drop-in basis (based on space availability). Children's World also offers summer field-trip programs. If you're interested, please call 303-494-3694. Many other daycare facilities are listed in the Boulder telephone directory under "Child Care."

Registration Form 1996 Eleventh Summer NSF CEDAR Workshop June 16-22, 1996

1.	PLEASE PRINT						
	Name:						
	Institution:						
	Address:						
		-					
	Telephone: ()	Fax: ()				
	E-mail:		Citizenship:				
	Are you a: NOTE: Registra This late fee will should register	Student (tions received be waived for before April) Tutorial Speaker () Neither () after May 31 will be charged a \$15 late fee for non-students and a \$5 late fee for students. those registering ONLY for Friday-Saturday. Students wanting travel or per diem funds 15.				
2	I plan to prese jeff_thayer@c	ent a poster on m.sri.com) in	Tuesday, June 18. NOTE : Send the title and author list to Dr. Jeffrey Thayer (e-mail is order to be considered. Please be sure to indicate whether or not the first author is a student.				
3	I plan to atten	d the Poster Se	ession/Reception at the UMC on Tuesday, June 18. (Time: 3 - 6PM Guests are also invited.)				
4	I plan to atten	d the buffet at	NCAR on Wednesday, June 19. (Additional \$15; free for students and tutorial speakers.)				
5	I and any gue: (Making a lad	sts plan to atter y out of a poor	nd the Boulder Dinner Theater Thursday, June 20 for dinner and the musical "My Fair Lady." girl. Extra fee of \$23/person payable to Barbara Emery.)				
6	I plan to atten	d the joint CE	DAR/GEM session on Saturday, June 22.				
7.	FEES: The regular and assessment of 1 STUDENTS AND contributions for al- provided they regi buffet will be funde contribution is \$10.	t total fee for the fact fees. The fact fees. The fact fees. The fact fees for the f	the CEDAR Workshop is \$95. It could be more or less depending on attendance at the buffet Fee for attending Friday-Saturday only is \$20. NOTE 1: ALL FEES ARE WAIVED FOR SPEAKERS. Fees for guests are not waived, nor are late assessments. [Any voluntary tratefully accepted.] NOTE 2: Foreign registrants are not assessed the late fee of \$15, 1; they may wait to pay their fees at the meeting. NOTE 3: Any alcohol at the reception and of voluntary contributions (f) below. We need about \$400-\$500, so a suggested voluntary				
	contribution is \$10	(a)	Regular registration \$80.00 (Sun June 16 - Sat Jun 22)				
		(b)	Registration for ONLY Fri June 21 & Sat June 22 \$2000				
		(c)	Registration for retirees \$20.00 (June 16-22)				
		(d)	NCAR buffet \$15.00 (Wed June 19)				
		(e)	Guests for NCAR buffet \$15.00/ea or \$7.50/child				
		(f)	Voluntary contribution for alcohol at reception/buffet				
		(g)	Late fee if registering after May 31 \$15.00				
NC)TE: If registratio	(h) n payment is r	Late fee FOR STUDENTS registering after May 31 \$5.00 TOTAL FEES oot enclosed with this form, please be certain that checks sent separately identify you and the				

workshop. Checks for the workshop should be made payable to NCAR. NCAR does not accept VISA or MasterCharge. Foreign registrants may pay on arrival provided they mail their registration forms in early. Please send correspondence to: Barbara Emery, HAO/NCAR, P.O. Box 3000, Boulder, CO 80307-3000; Phone: (303) 497-1596; Fax: (303) 497-1589; Internet: emery@ncar.ucar.edu; SPAN: 9580::"emery@ncar.ucar.edu".

STUDENTS Please complete BOTH sides of this registration form.

Application for Student Financial Support to Attend the Annual CEDAR Meeting

All students are eligible to receive a registration fee waiver, including those from non-U.S. institutions. All non-local students are eligible to receive either a double dorm room or a small per diem. Travel funds are also available for students from U.S. institutions. All students must fill out this application form, which provides input for the list of students and their interests, made available at the meeting. Application deadline is **April 15, 1996.** See the write-up about travel grants for more information. If this form is returned via e-mail, the advisor can send a short e-mail indicating awareness and approval of the student's application for funding.

PLEASE PRINT

Name:					
University Address:					
			-		
Phone: ()	Fax:()	E-mail: ()		
Mailing Address (if diff	ferent):				
Do you need a parki	ng permit? Yes	(Permits will be	available at Kittredge	Commons for those	
whose names are on	a distribution list Otherw	ise, the cost is \$15 f	rom campus police.)		
Expected Degree and I	Date of Graduation:	and the second second			
Advisor(s) and Phone	Number:				
Research Interests:					
	~ ~	LI LE RAS			
Instruments, Models, o	r Data Used:				
	Alexandron and a second s				

Advisor's Signature of Student Status:

I confirm that the applicant is a () graduate () undergraduate student at my university or research laboratory and is working on a research project related to the CEDAR Program.

Signature of Research Advisor:

1996 CEDAR Workshop forms: send completed forms for registration and request for funding (all students should fill this out) to: emery@ncar.ucar.edu

University of Colorado Summer Conference Housing Application Main Campus

PLEASE COMPLETE THE INFORMATION REQUESTED BELOW AND SEND TO THE ADDRESS INDICATED AT THE BOTTOM OF THIS FORM.

Name of Conference: NSF CEDAR Meeting, Summer 1996

Name of Participant:			(first)	Sex:				
	(last)		(first)					
Lodging: First Night	(date)	Last Night:		(date)				
Address:	C	ity:	State:	Zip:				
Telephone: (Home)		(Business)						
Please request one of the f	ollowing:							
*Single Room	*Single Room Double Room (Roommate Preference if Any)							
Special Requests (Sm	Special Requests (Smoker/Nonsmoker, etc.)							
*There are a limited number of single rooms. If a single room is unavailable, you will share a double room with another conference participant. Double rooms FOR STUDENTS ONLY will be paid by NCAR. Singles must be paid for by the participant upon check-in.								
Complete if Accompanied by Spouse and/or Family:								
Spouse's Name		Lodging: First Nig	ght La	ast Night				
Children: Name	/Age Sex	_ Dbl Sngl	1st Night	Last Night				
Name		_ Dbl Sngl	1st Night	Last Night				
Name		_ Dbl Sngl	lst Night	Last Night				
Will a rollaway bed be need	eded? Crib?	Total Number i	n Party					

PAYMENT IS DUE AT CHECK-IN. Cash, traveler's checks, personal checks, VISA and MasterCard will be accepted. DO NOT SEND MONEY IN ADVANCE.

MAIL TO: Kittredge Commons University of Colorado Boulder, CO 80310 or Fax: (303) 492-5959 e-mail: TBD (can send to emery@ncar.ucar.edu)



Prof. Jeffrey M. Forbes Aerospace Engineering Sciences CB 429 University of Colorado Boulder, CO 80309-0429

Address correction requested.

Barbara Emery NCAR High Altitude Observatory P. O. Box 3000 Boulder, CO 80307-3000

The Cedar Post is published quarterly and mailed to more than 1400 scientists worldwide. J. M. Forbes, Editor P. Gassaway, Production Manager

NOTE: Back issues of *The CEDAR Post* are available to interested scientists and students. Also available: *Coupling, Energetics, and Dynamics of Atmospheric Regions* (*CEDAR*), *An Interim Review, 1988-1992*, a comprehensive review of the first five years of the program. These items may be requested from the CEDAR Science Steering Committee Chair (currently Dr. Jeffrey M. Forbes at the address listed above).

Nonprofit Org. U.S. Postage PAID Permit No. 257 Boulder, CO