

THE NEW ASTRONOMY: OPENING THE ELECTROMAGNETIC WINDOW
AND EXPANDING OUR VIEW OF PLANET EARTH

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THE NEW ASTRONOMY:
OPENING THE
ELECTROMAGNETIC
WINDOW AND EXPANDING
OUR VIEW OF PLANET EARTH

A Meeting to Honor Woody Sullivan
on his 60th Birthday

Edited by

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Cosmic evolution is depicted in this image from the exobiology program at NASA Ames. Upper left: the formation of the stars, the production of heavy elements, and the formation of planetary systems, including our own. At left: prebiotic molecules, RNA and DNA are formed within the first billion years on the primitive Earth. At center: the origin and evolution of life leads to increasing complexity, culminating in intelligence, technology, and astronomers. Upper right: contemplating the Universe. The image was created by David DesMarías, Thomas Scattergood and Linda Jahnke at NASA Ames in 1986, and reissued in 1997.

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FOREWORD

This is an unusual book, combining as it does papers on astrobiology, history of astronomy and sundials, but—after all—Woody Sullivan is an unusual man. In late 2003 I spent two fruitful and enjoyable months in the Astronomy Department at the University of Washington (UW) working on archival material accumulated over the decades by Woody, for a book we will co-author with Jessica Chapman on the early development of Australian astronomy. The only serious intellectual distraction I faced during this period was planning for an IAU colloquium on transits of Venus scheduled for June 2004 in England, where I was down to present the ‘Cook’ paper. I knew Woody was also interested in transits (and, indeed, anything remotely connected with shadows—see his paper on page 3), and in discussing the Preston meeting with him it transpired that his 60th birthday was timed to occur just one week later. This was where the seed of ‘Woodfest’ began to germinate. Why not invite friends and colleagues to join Woody in Seattle and celebrate this proud event? I put the idea to Woody and others at UW, they liked it, and ‘Woodfest’ was born.

The hard work involved in organising the logistics of the meeting fell into the capable hands of the Local Organising Committee, Bruce Balick, Jim Evans, Bruce Hevly (co-Chair) and Karl Hufbauer (co-Chair), while the program was addressed by a Scientific Organising Committee comprising John Baross, Ron Bracewell, David DeVorkin, Steven Dick, Ken Kellermann, Wayne Orchiston (Chair), Robert Smith, Richard Strom and Virginia Trimble. For his part, Woody became a *de facto* member of both Committees, and an excellent sounding board for our various ideas and the innumerable problems associated with organising a meeting.

Woody was also invaluable when it came to attracting speakers, particularly those in the astrobiology fold who lay well outside my own sphere of contacts. The final product was a meeting that had an almost equal mix of history of astronomy and astrobiology papers interwoven through the program, and three papers which we referred to as ‘Woody indulgences’, on sundials, art and the history of science. The full program is shown on pages xi-xiii. In addition, Frank Drake kindly agreed to present a public lecture, which was organised by the LOC and Linda Khandro, in conjunction with the University’s Center for Astrobiology and Early Evolution.

The SOC also arranged a reception and the Conference Banquet. This unforgettable latter event was on the night of Woody’s birthday, down on

the waterfront, and in addition to singing “Happy Birthday” to Woody we all joined him in a rather forgettable rendition of a number of rather forgettable Tom Lehrer songs, including “The Elements”! All in all it was a memorable night.

At the end of the Conference, some participants took part in a one-day outing to Mount Rainier. This enjoyable scenic field trip (see page xvi) was organised by the SOC.

From the start, we hoped to publish the papers from Woodfest, so it was very pleasing when Harry Blom from Kluwer (now Springer) heard about the Conference and approached us with a proposal that we could not refuse. My only regret is that most of those who presented astrobiology papers at Woodfest had already published much of their material elsewhere and so decided not to contribute to this volume. Those papers that are included are marked by asterisks on pages xi and xii.

Finally, it remains for me to thank the UW Kammeyer Fund and members of the LOC and SOC for making Woodfest happen; all those who presented papers at the conference; Harry Blom, Sonja Japenga and Kirsten Theunissen from Springer for seeing this volume safely through the press; Wolfgang Dick, Hilmar Duerbeck and Sandra Ricketts for helping me chase down those all-too-elusive references; Bruce Balick, David DeVorkin and Joe Tenn for kindly supplying photographs; and last but not least, our dear friend and colleague, the inimitable Woodruff T. Sullivan, III, for making the very concept of ‘Woodfest’ a reality. Happy Birthday Woody; these proceedings are our final—if somewhat belated—present to you. Enjoy ...

Wayne Orchiston

Chair, SOC

PARTICIPANTS

Peter Abrahams (USA)
Bruce Balick (USA)
John Baross (USA)
William Baum (USA)
Keith Benson (USA)
Ron Bracewell (USA)
Ron Brashear (USA)
Christopher Chyba (USA)
Carol Cleland (USA)
Marshall Cohen (USA)
Rebecca Cummins (USA)
Jody Deeming (USA)
David DeVorkin (USA)
Steven Dick (USA)
Frank Drake (USA)
Jim Evans (USA)
Richard Gammon (USA)
Miller Goss (USA)
Mott Greene (USA)
Alastair Gunn (UK)

Tom Hankins (USA)
Bruce Hevly (USA)
Karl Hufbauer (USA)
Richard Jarrell (Canada)
Ken Kellermann (USA)
Julie Lutz (USA)
Geoff Marcy (USA)
Wayne Orchiston (Australia)
Robert Smith (Canada)
Richard Strom (The Netherlands)
Woody Sullivan (USA)
Paula Szkody (USA)
Joe Tenn (USA)
Daniel Tomandl (USA)
Virginia Trimble (USA)
Ed Turner (USA)
George Wallerstein (USA)
Peter Ward (USA)
Dan Werthimer (USA)

‘WOODFEST’ PROGRAM

Papers published in these Proceedings are followed by an asterisk.

Day	Time	Program
Wednesday 16 June	9.00	<i>Chair: Bruce Hevly & Karl Hufbauer</i> Bruce Hevly & Karl Hufbauer: General house-keeping
	9.10	Woody Sullivan: Welcome
	9.15	Bruce Balick: Introduction
	9.30	Steven Dick: “The Biological Universe revisited”*
	10.00	Chris Chyba: “Contingency and the cosmic perspective”*
	10.30	<i>Morning Tea</i>
	11.00	<i>Chair: Robert Smith</i> Ken Kellermann: “Grote Reber: founding father of radio astronomy and professional amateur”*
	11.30	Alastair Gunn: “Rays, radiants and radishes: early radio astronomy at Jodrell Bank”*
	12.00	Richard Strom: “Radio astronomy in Holland before 1960: just a bit more than HI”*
	12.30	<i>Lunch</i>
	2.00	<i>Chair: Steven Dick</i> John Baross: “Parallel habitats on Earth, planets and moons”
	2.30	Peter Ward: “A taxonomy of habitable planets: assessing the odds of life in variable planetary systems”
	3.00	Carol Cleland: “The advent of historical science”
	3.30	<i>Afternoon Tea</i>
	4.00	<i>Chair: Bruce Balick</i> Robert Smith: “The history of space astronomy: an attempt to see the big picture”*
	4.30	Peter Abrahams: “Telescopes lofted to space”*
	5.00	David DeVorkin: “SAO during the Whipple years: Project Telescope”*
	5.30	Reception
	8.00	Public Lecture <i>Chair: Woody Sullivan</i> Frank Drake: “New approaches in the search for SETI”

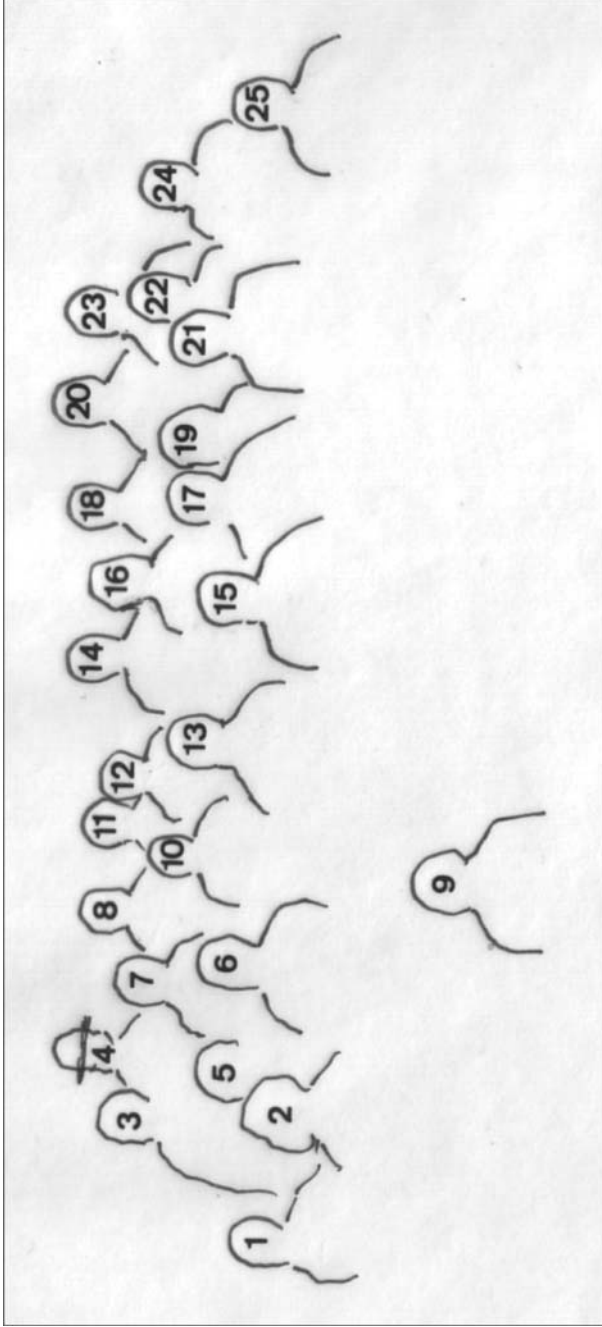
Thursday 17 June	9.00	<i>Chair: Ken Kellermann</i> Wayne Orchiston & Bruce Slee: “The Radiophysics field stations and the early development of radio astronomy”*
	9.30	Marshall Cohen: “Owens Valley Radio Observatory and dark matter”*
	10.00	Wayne Orchiston: “Dr Elizabeth Alexander: first female radio astronomer”*
	10.30	<i>Morning Tea</i>
	11.00	<i>Chair: Virginia Trimble</i> Geoff Marcy: “Extra-solar planetary systems”
	11.30	Ed Turner: “Detection and characterization of extra-solar planets and plants”
	12.00	Rebecca Cummins: “Light work: contemporary artists consider the Sun”*
	12.30	<i>Lunch</i>
	2.00	<i>Chair: David DeVorkin</i> Ron Brashear: “The transits of Venus and new astronomies: a time to reflect”*
	2.30	Bruce Hevly: “X-rays, extreme ultraviolet and the life of instruments”
	3.00	Virginia Trimble: “The origin of gamma ray astronomy: when one photon was a discovery, two was a spectrum, and three was the Rossi Prize”*
	3.30	<i>Afternoon Tea</i>
	4.00	<i>Chair: Richard Strom</i> Jim Evans: “Gnōmonikē Technē: the dialer’s art and its meaning in the Ancient World”*
	4.30	Karl Hufbauer: “Radio studies of solar phenomena, 1946-1958: their significance?”
	5.00	Richard Jarrell: “‘Radio astronomy ... whatever that is’: the marginalization of early radio astronomy in astronomy”*
	5.30	<i>End of Session</i>
	7.00	Conference Banquet
Friday 18 June	9.00	<i>Chair: Jim Evans</i> Mott Greene: “Astrobiology and anthropomorphism: are we still looking for ourselves?”
	9.30	Frank Drake: “Lessons from the history of SETI”
	10.00	Dan Werthimer: “Do we know how to search for ET?”

	10.30	<i>Morning Tea</i>
		<i>Chair: Wayne Orchiston</i>
	11.00	Bruce Balick: “Discovery of Sgr A*: an exposé”*
	11.30	Miller Goss & Ron Ekers: “The discovery of Sgr A and the almost discovery of Sgr A* in Big Pine – The impact of Galactic Center research since 1951”
	12.00	Woody Sullivan: “Points of view: shadows, planets and life”*
	12.30	<i>End of Conference</i>

CONFERENCE PHOTOGRAPH



Some of the Woodfest Conference participants (for identifications see the following page).



Key: 1 = Alastair Gunn, 2 = Carol Cleland, 3 = Steve Dick, 4 = Karl Huftbauer, 5 = Virginia Trimble, 6 = Joe Tenn, 7 = Bruce Balick, 8 = William Baum, 9 = Peter Abrahams, 10 = Wayne Orchiston, 11 = Marshall Cohen, 12 = Richard Strom, 13 = Ken Kellermann, 14 = Ron Brashear, 15 = Woody Sullivan, 16 = Ed Turner, 17 = Bruce Hevly, 18 = Dan Tomandl, 19 = Rebecca Cummins, 20 = Richard Jarrell, 21 = Geoff Marcy, 22 = Dan Werthimer, 23 = Miller Goss, 24 = Frank Drake, 25 = David DeVorkin.



Top: Woody discusses the basics of sundial design. *Bottom:* The Mount Rainier excursion.

INTRODUCTION