# John Payne's ALMA Photonics Work

2006-10-26

## ALMA Photonics start date? – email to Bob Brown April, 1996

Bob,

I'd like to report on what I've been able to do on the laser LO scheme. The whole field of fibre optics is moving very fast with new products appearing weekly. One of the fastest moving seems to be the development of products for the 1.5 micron wavelength. This is the wavelength at which the most frequently used fibre has the least loss. By coincidence this is the same wavelength at which maser behavior takes place in erbium doped glass. Amplifiers and lasers are now available using this effect. for our purpose the lasers being produced by using erbium doped fibre look ideal. The spectral purity is amazing- line widths of less than 10KHz and the device is smoothly tuneable from 1520- 1568nm. The power output is around 10mW and, in any case there are high power amplifiers available using the same effect that give up to 100mW!...

Phase locking the thing looks easy-it has a very fine frequency control that looks ideal...

I don't have exact costs yet and things may change in the next day or two as we are talking to the laser experts at the optical science center but right now I feel just about ready to place some PO s.My best guess right now for a proof of concept experiment would be 20-30k. Got any thoughts on this?



# Idea #1: Phase Locking Two Lasers







## John's Vision: Laser "Synthesizer" for Direct Photonic LO to 950 GHz



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## Idea #2: Fiber Phase Control by use of an Optical Interferometer



## ALMA Photonic Reference for 1<sup>st</sup> LO



## **Optical Comb Generator**



## Photonic Phase Calibration – 660 GHz



- SAO Hot-Electron Bolometer Receiver
- Steward Observatory Submillimeter Telescope (SMT), Mount Graham, Arizona – 2002
- Sub-mm-wave heterodyne at 660 GHz using U2T-RAL Photomixer in Overmoded Waveguide-Horn
- ReceiverSpectrum of Photonic signal taken in Astronomical Total Power Calibration mode through Acousto-Optic Spectrometer Backend John Payne Tribute Symposium

Holography for Antenna Surface Measurement



Jd

## **Photonic Transmitter Installed**



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## RAL Photomixers: Current Design

Design modified during production to incorporate revisions requested by NRAO. Changes were

- Flange Modifications
- Fibre Pigtail and Connector



Top and bottom views of Photomixers - devices are about 25 mm x 25 mm

# John Payne's EDIRs

61	Frequency Sweeper	J. Payne	9/1/1967	LO
62	Noise Tube Power Supply	J. Payne	9/1/1967	Calibration
63	Thermal Calibration Unit	J. Payne	9/1/1967	Calibration
72	A Remote Positioning Servo System	J. Payne	6/1/1968	Antenna
81	Front-End Box Temperature Controller	J. Payne	10/1/1968	Antenna
84	The 6 cm VLB Receiver	J. Payne	4/1/1969	FE
90	The 3 cm VLB Receiver	J. Payne	1/1/1970	FE
92	The 13 cm VLB Receiver	J. Payne	5/1/1970	FE
98	Antenna Measuring Instrument	J. Payne	11/1/1970	Calibration
101	The 108-Channel Multiplexer for use with the Honeywell 316 Spectral Line Processor	J. Payne	5/1/1971	Backend
103	Mark II Thermal Calibrator	J. W. Findlay, J. Payne	8/1/1971	FE
119	A Laser Distance Measuring Instrument	John M. Payne	6/1/1972	Calibration
127	The 45-Foot Antenna Drive System	J. Payne	3/1/1973	Antenna
134	A 512-Channel Integrator and Multiplexer	C. Pace, J. Payne	10/1/1973	Backend
136	An Antenna Measuring Instrument and Its Use on the 140-ft Telescope	J. W. Findlay, J. Payne	1/1/1974	Calibration
137	Nutating Subreflector for 36-ft Telescope	J. M. Payne	2/1/1974	Antenna
152	First Tests of An Antenna Measuring Instrument on the 36-ft Telescope	J. M. Payne, J. M. Hollis, J. W. Findlay	12/1/1974	Calibration

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# What JP taught me

- Don't shrink from risk, but don't ignore it
- Work Ethic: You are on the dime of the taxpayer, making instruments for Scientists, and representing the Observatory
- Time Spent in the lab counts double
- Understand the wiggles
- This can be fun

### Memorandum To: Becky Warner

### Subject: Green Bank Visitor Facilities

As I've been promising for sometime, here are suggestions for some changes that I feel would make a difference to people visiting Green Bank for a week or two.

A visit to Green Bank is always pleasant; the people are friendly and the work is very interesting. Please do not interpret any of these suggestions as criticism.

### Cafeteria

Breakfast

Have the following available: Oat Bran, Skim milk , Low-sodium VS juice , Greater variety of fresh fruit , Larger variety of cereal (granola, etc.) , Turkey sausage

#### Lunch

Generally speaking, the lunches are not too healthy, but one can always ask for something special. The 2-oz turkey sandwich, for example, is very good.

I'd like to see a real vegetable soup offered. It must be a shock for a vegetarian to order it and have it arrive with meat in it. A tremendous improvement in the quality of the food generally could be made by using fresh vegetables and produce. This is the single largest complaint that I have heard regarding the food, Canned vegetables are very unhealthy (loaded with sodium) and tasteless; the frozen ones are not much better. The fresh spinach salads you offer are very popular. I'm sure that other fresh choices would not go to waste.

#### Dinner

The dinner menu is pretty ancient and should be revised. I'd like to see healthier things on the menu. Broiled chicken breast, broiled fish (no batter), and baked potato are a few suggestions. Low sodium soups would be nice, too.

#### Lounge

The lounge is a nice place to relax after work. I have a few suggestions that I feel would

make life a little nicer for the visitor.

### TV

This is really the main source of entertainment for a visitor to Green Bank, It would be nice to have a TV Guide in the lounge so that one could plan ahead to see an interesting program. It's also a little disconcerting to see a satellite system outside the lab and yet be limited to just a few channels in the lounge,

#### **Reading Materials**

For the last 25 years the bulk of the reading material in the lounge has been largely limited to books discarded from the Port Jefferson Public Library. Recently, things have improved greatly by Jay Lockman's kind donation of various current magazines. A separate paperback book shelf—take one, leave one—might be nice, I would suggest clearing out all the old books.

### Food

Quite often after working late I get very hungry. Would it be possible to arrange for sandwich fixings or cheese and crackers, fruit, etc., to be paid for on the honor system like the drinks?

#### Stereo

I reckon I'm a reasonable engineer, but the stereo sometimes just beats me. It would be really nice to have just a few movies as well, I've watched "Casablanca" about three times,

c: J. Lockman and A. Fleming