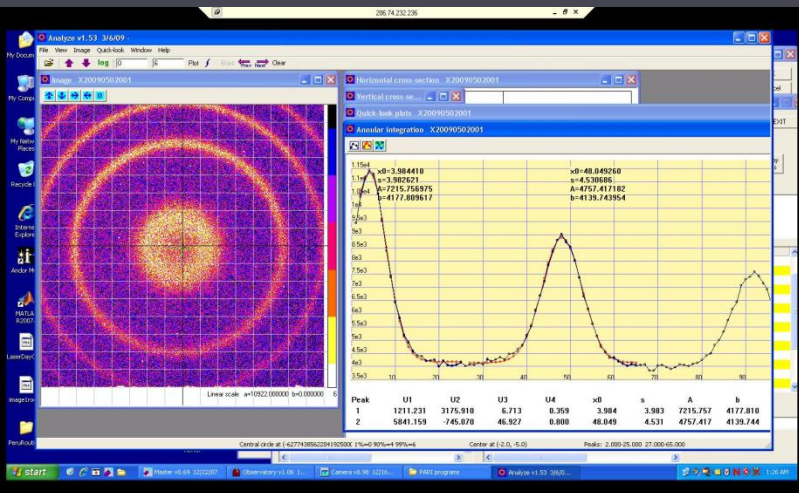




ROVOR: Remote Observatory for Variable Object Research

J. Ward Moody, Brett Little, Ben Boizelle
Jacob Nelson, Kim Bates, Michael Abbott BYU
Jonathan Barnes SLCC
Alberto Sadun U of Denver

- Remote Observing started for me in 1985 in Peru.
- U of Michigan Space Physics Research Lab Arequipa airglow station



ROVOR

- ⦿ 16-inch RC Optical telescope
- ⦿ Paramount ME
- ⦿ Refurbished AP8 CCD
 - 1.375-arcsec/pixel
 - 23 x 23-arcmin FOV
- ⦿ Weather station & all-sky Cam



2010/03/17
00:19:29
13.8241s

000004177



Why Build ROVOR?

- ⊙ Improve the economics of observing
 - Inexpensive yet robust
 - Easy to maintain
 - Transfer learning & technology to other telescopes
- ⊙ Educate
 - Students cannot take classes all day and observe all night.
- ⊙ Produce good science
 - Still room to explore the bright-sky time domain.
- ⊙ I just wanted to!
 - I would love to operate a dozen of these!

First Technology Transfer

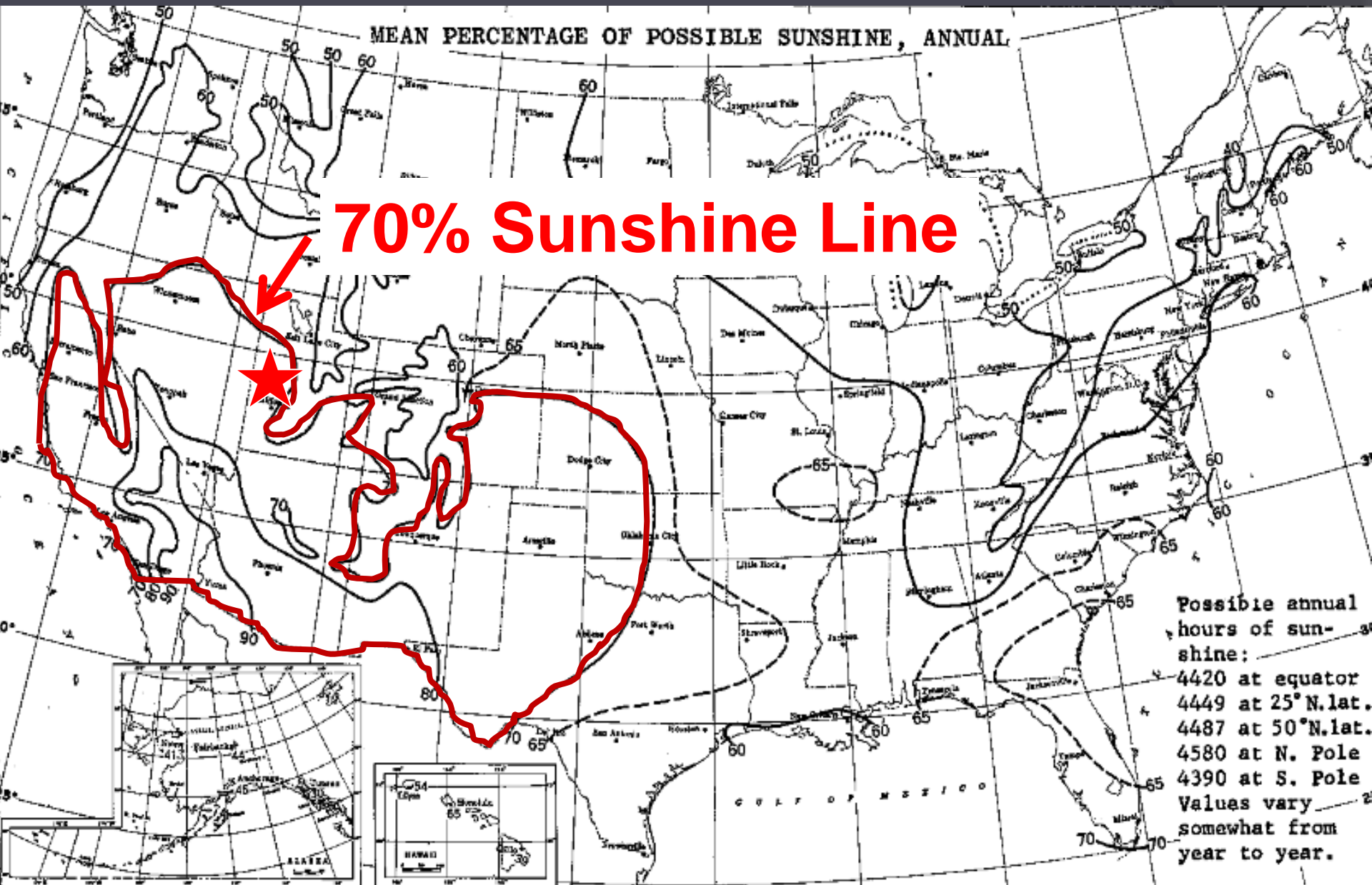
- West Mountain Observatory
 - DFM 0.9 m commissioned last year
 - 12" and 20" RCO & Paramount systems
- Eventually run the small scopes like ROVOR



The ROVOR Site: Dark



Clear



Fairly
Close

120 miles
from
campus





Lifferth Dome

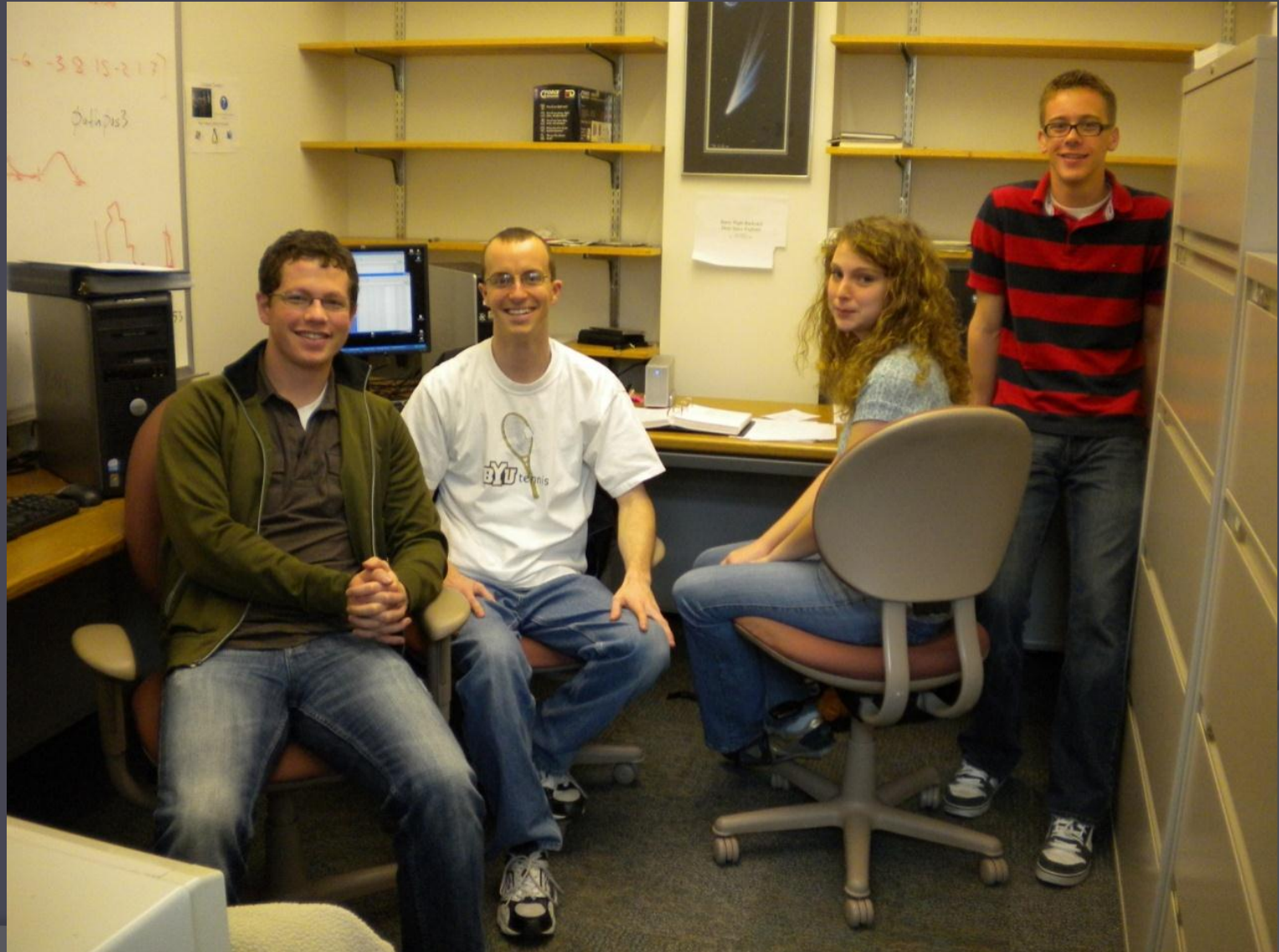
Roof pulls off in 2m 20s
with a 1 amp motor



~\$10K to build.
Very robust
Camouflage colors



Always a team of 4 to 6 Astronomy Majors



Having
fun is
important!

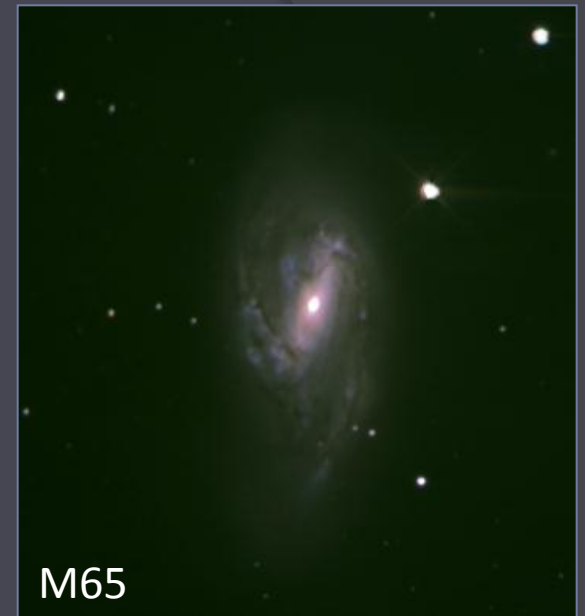
This and
other images
were on
display in our
art building
last semester.



Tearsa and Bret Little rendition of M42

Science

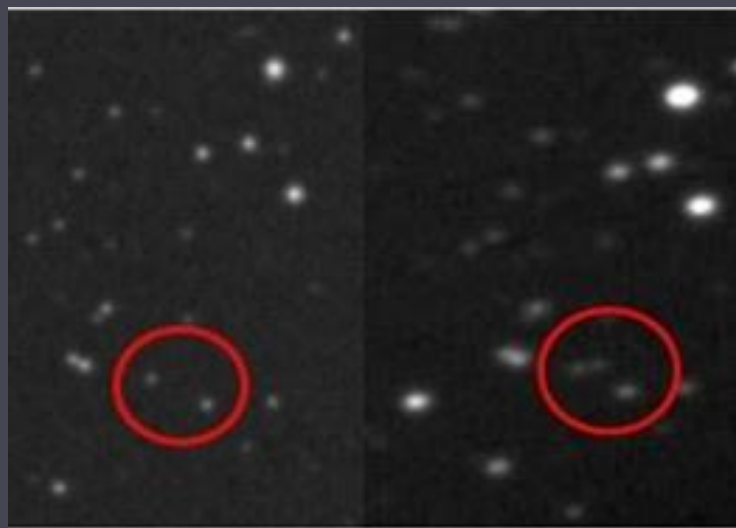
- ◉ Gamma-ray burst searches and circular publications (4; ongoing)
- ◉ High-energy, TeV blazar standard stars (Finished; preparing paper)
- ◉ Long-term variability of TeV blazars Mrk 501 & Mrk 421 (2 publications, one in preparation) and x-ray binaries (just begun)
- ◉ Weekly B & R band monitoring of the 100 brightest QSOs/blazars. (Started this month)



TITLE: GCN CIRCULAR
NUMBER: 9318
SUBJECT: GRB 090429A: ROVOR magnitude limit
DATE: 09/05/01 15:46:47 GMT
FROM: J. Ward Moody at BYU <rovor.byu@gmail.com>

Richard L. Pearson and J. Ward Moody report for Brigham Young University's ROVOR team:

We observed the field around GRB 090429A (Swift trigger 350853, Markwardt et al., GCN 9280) with the ROVOR (Robotic Observatory for Variable Object Research) 16" telescope from Delta, Utah. Beginning 30 April 2009 at 03:46:50 UT (22.3 hours after outburst), observations were obtained for a complete integration time of 50 minutes in white light. No detection was made after stacking the images. Using the magnitude limits established by Olivares et al., GCN Circ. 9303 on the 2.2m ESO/MPI telescope at La Silla Observatory, we estimate a magnitude limit of 22 ± 1 mag on these observations.



GRB100418A detected April 19, 2010



GRB 090429A (not detected)

BVRI standards for the northern TeV blazars

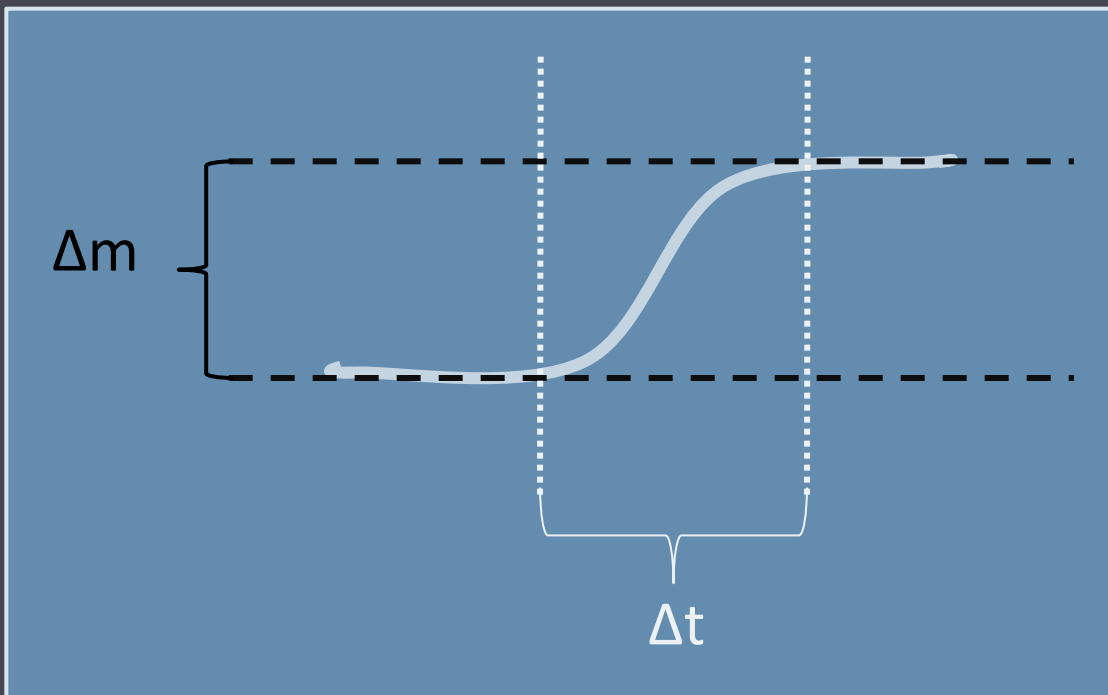
- 3C66 A
- Mrk 421
- M87
- H1426+428
- Mrk 501
- 1ES 1959+650
- BL Lac

Verify existing standards
Fill in missing bands



0.01-0.03 mag
absolute accuracy

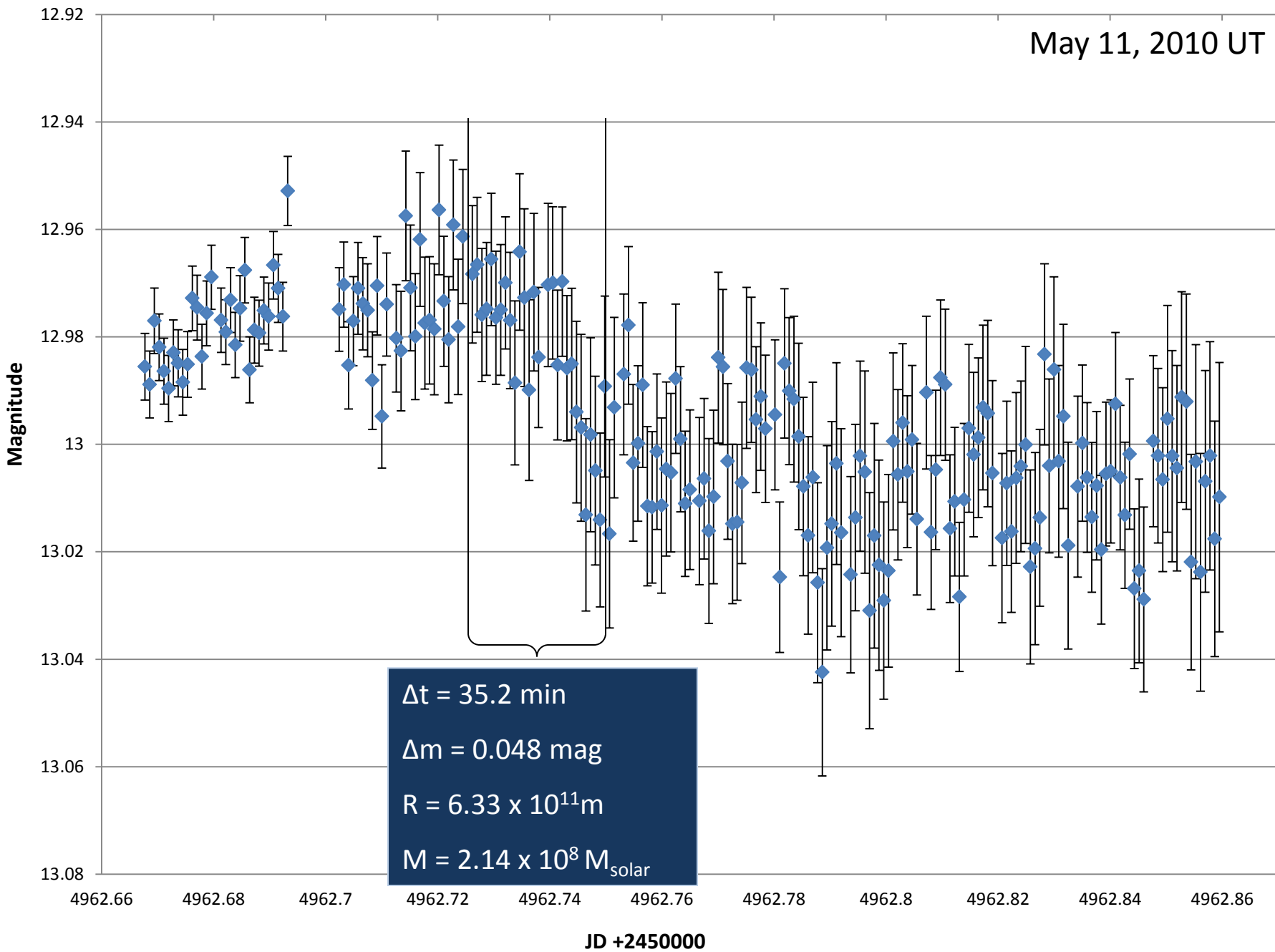
Black Hole Mass Constraints from Variations



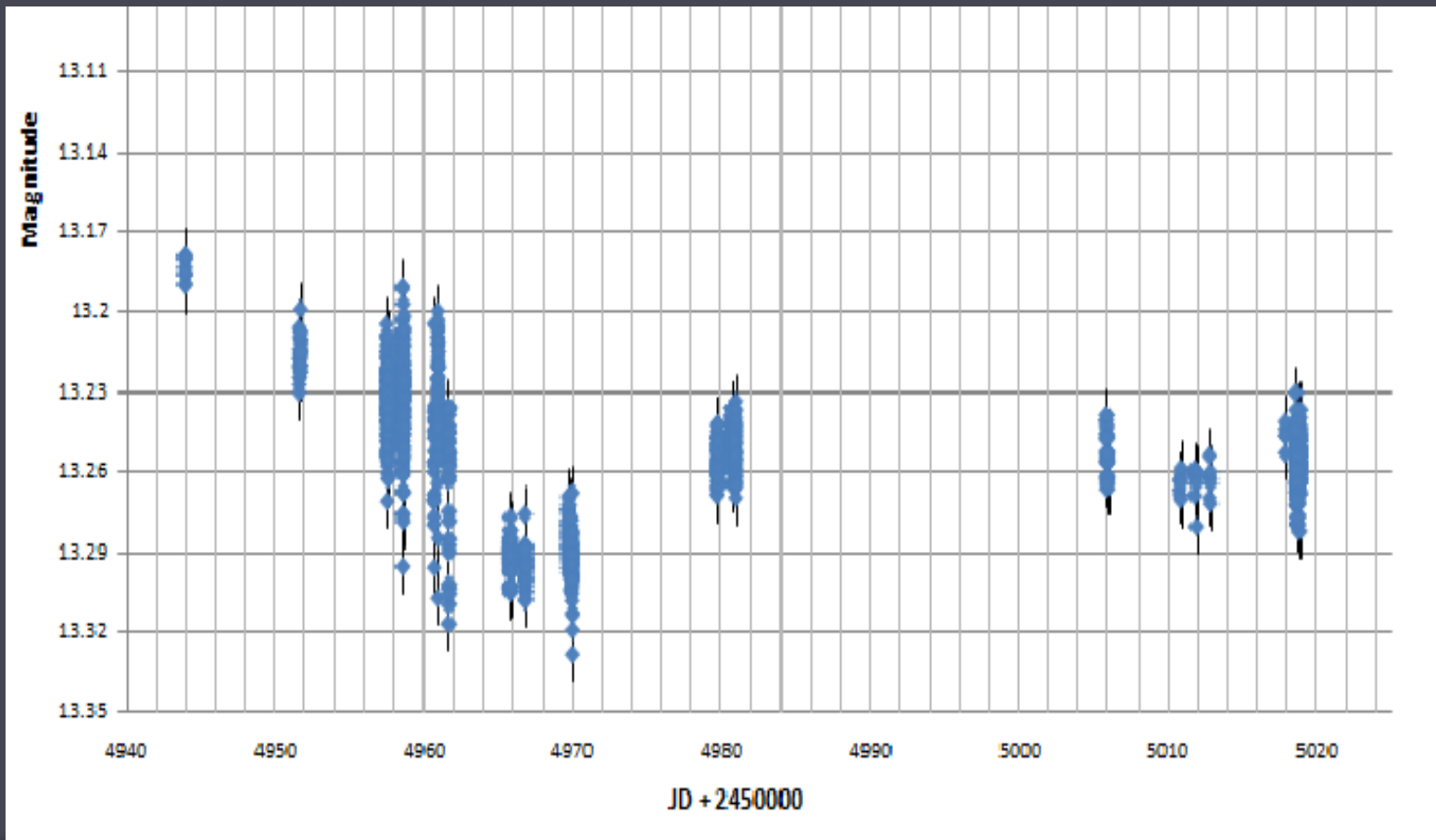
$$R \leq c\Delta t$$

$$M \leq \Delta t \frac{c^3}{2G}$$

May 11, 2010 UT



72 day period in Mrk 501



Future

- ⦿ Refine science and extend collaborations.
- ⦿ Improve data reduction pipeline.
 - We use Mira Pro Ultimate with scripts
 - Eventually ROVOR will send us object magnitudes, not frames.
- ⦿ Build the next one!