



Seven Years in ESO, Prague 2014



Introducing The Vatican Observatory

Fr. Paul Gabor, S.J., Ph.D.



Purpose of the Vatican Observatory?

MISSIONARIES FOR MARS?

POPE JOHN PAUL II has ordered his team of "astropriests" to be ready to go at a moment's notice.

By LAUREL BOWIE
Correspondent

VATICAN TRAINING 24 PRIESTS TO SPREAD GOSPEL TO SPACE ALIENS!



TWO ASTROPRIESTS prepare for their first space launch in search of extraterrestrials on the planet Mars.

VATICAN CITY, Rome — Two dozen daring young Roman Catholic priests have completed a top-secret, six-year program preparing them to serve as missionaries — in the farthest reaches of outer space!

And the Vatican has ordered the clerics on standby alert — ready to fly off to the stars the minute we make official contact with life on another planet.

"This is a truly staggering development, because for the first time the Church is recognizing that human beings are not the only intelligent creatures in the universe," theology professor Dr. Rudolph Koller told reporters in Salzburg, Austria.

"And it signals that the Vatican is prepared to spend millions, even billions, of dollars to convert extraterrestrials to a religion that is almost certainly foreign to their own."

Weekly World News first reported that the Church was training a bold new breed of missionary to travel to Mars and beyond back in January 1988, after word leaked that a secret UFO section

had been established at the Vatican University's Almonian Academy.

The program was designed to assure that the Catholic Church leads the way "when the time comes to Christianize alien societies," a Vatican source said.

During the five years since then, 24 handpicked priests from around the world — including four Americans — have undergone intensive training in "approaches and techniques" to be used in spreading the gospel in space.

"These men are now fully trained to take on the most challenging mis-

sion in the history of organized religion," the source said.

"Pope John Paul II has ordered them to be ready to go at a moment's notice."

Father Pierre Sorel, a Vatican theologian, insists it's vitally important that the Church prepare itself to begin missionary work among the stars.

"The existence of alien races in outer space is hardly certain," he said. "Still, we cannot afford to ignore space exploration or the possibility of meeting other living creatures."

But Franco D'Alema, newly elected president of the Rome-based Citizens for Non-Intervention in Alien Affairs, urged the Vatican to abandon its "foolhardy" plan to convert aliens to Catholicism.

"We are about to embark on the most mind boggling period of discovery mankind has ever seen, a time when we will be introduced to beings unlike anything we can presently imagine," D'Alema said.

"Let's not mess it up by preaching and thumping our Bibles. That will only make other residents of the universe grow to despise us."

Weekly world News

October 20, 1993





Origins: 16th Century



- two currents of Church astronomy in Rome: SJ and Pope



Origins: 16th Century



- two currents of Church astronomy in Rome: SJ and Pope

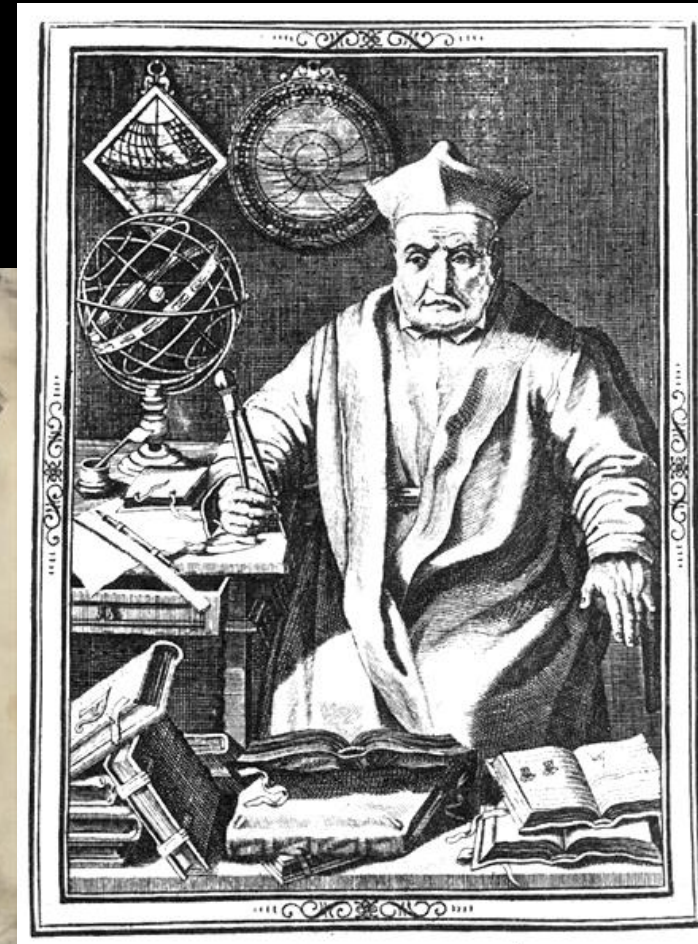




Origins: 16th Century



- two currents of Church astronomy in Rome: SJ and Pope
- Fr. Christoph Clavius, S.J. (*1538, +1612)

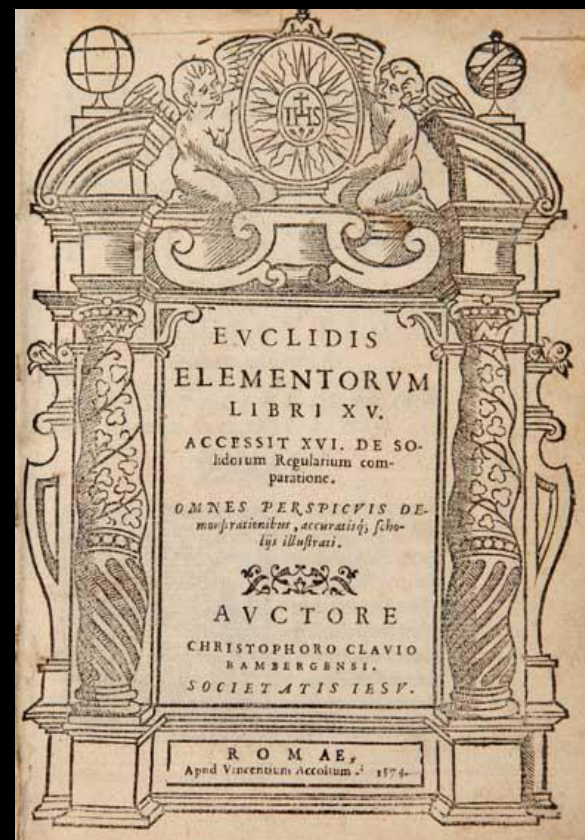
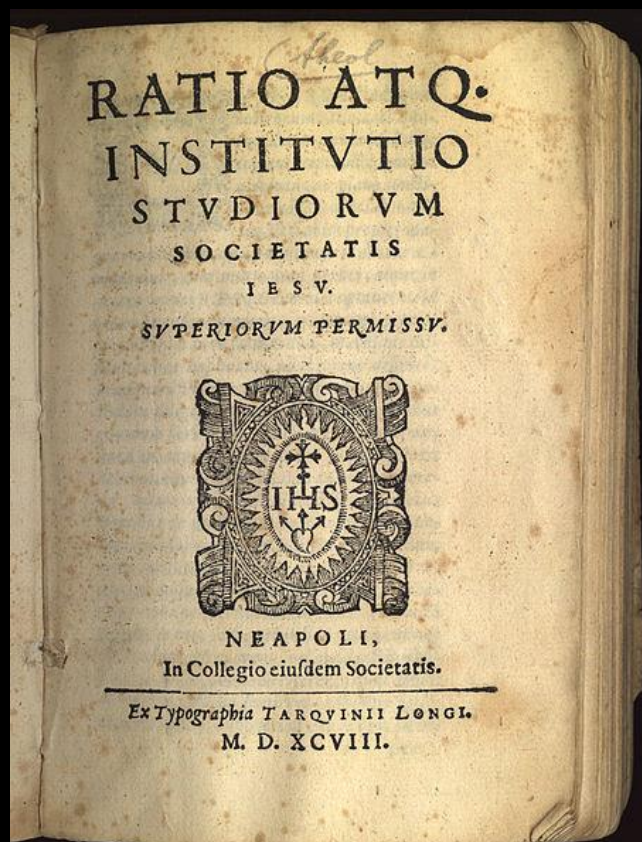




Origins: 16th Century



Society of Jesus & schools
Roman College (1551; today Gregorian University)
Clavius -- Chair of Mathematics (1565)
Clavius >>> Ratio Studiorum (1599)

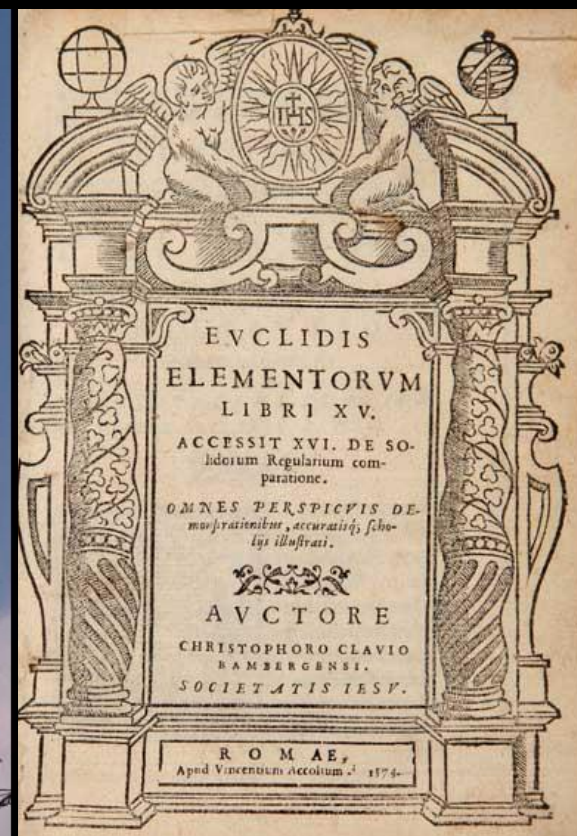
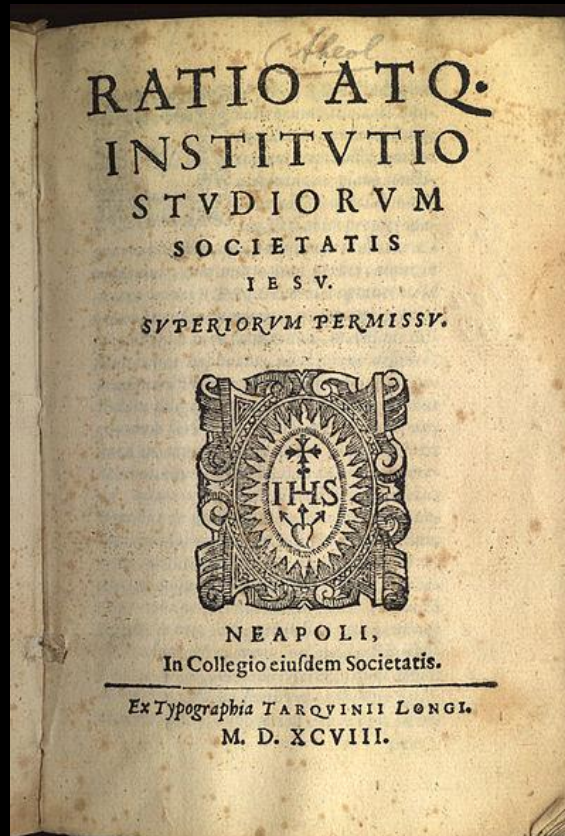




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Origins: 16th Century



- two currents of Church astronomy in Rome: SJ and Pope
- Fr. Christoph Clavius, S.J. (*1538, +1612)
- Gregory XIII (*1502, Pope 1572, +1585)
- calendar reform





Origins: 16th Century



- calendar reform



- 1582:

Thu 4 Oct (Julian) → Fri 15 Oct (Gregorian)

Paul Gabor, 14 Apr 2014



Specola Vaticana



Two locations:

1. Castel Gandolfo

- headquarters
- historical library
- collection of meteorites
- conference center

2. Tucson

- observational facilities



Vatican Observatory



- Rome
- "Colli Albani"
volcano
- 25 km SE of Rome





Vatican Observatory



- Rome
- "Colli Albani"
volcano
- 25 km SE of Rome





Vatican Observatory



- Rome
- "Colli Albani" volcano
- 25 km SE of Rome





Vatican Observatory



- Rome
- "Colli Albani" volcano
- 25 km SE of Rome
- Castel Gandolfo
- Pope's summer residence





Specola – Castel Gandolfo





Specola – Castel Gandolfo





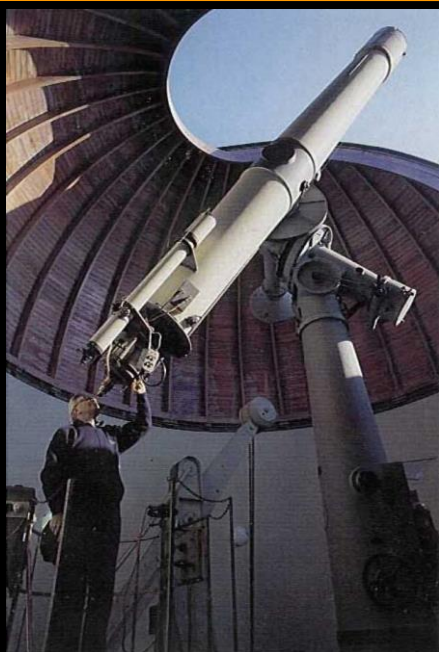
Specola – Castel Gandolfo



Paul Gabor, 14 Apr 2014



Specola – Castel Gandolfo



Visuale

$D = 40 \text{ cm}$

$f = 6 \text{ m}$

Double
astrograph

$D_{\text{Refl}} = 60 \text{ cm}$

$D_{\text{Refr}} = 40 \text{ cm}$

Schmidt

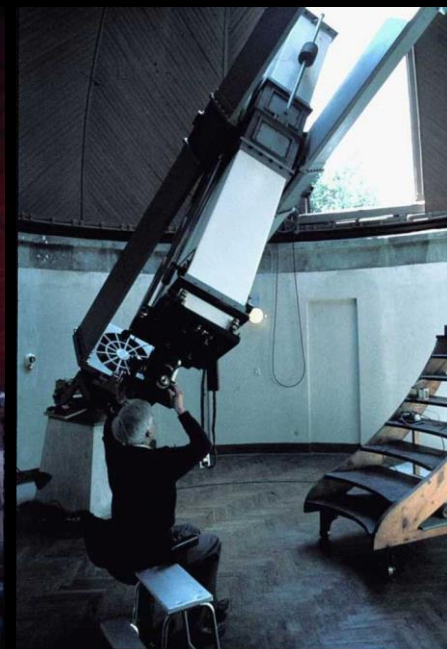
$D_{\text{mirr}} = 98 \text{ cm}$

$D_{\text{corr}} = 65 \text{ cm}$

Carte-du-ciel

$D = 33 \text{ cm}$

$f = 343 \text{ cm}$





Vatican Observatory



Light pollution



Vatican Observatory



Light pollution
1960s - Sardinia?



Vatican Observatory



Light pollution

~~1960s - Sardinia?~~

1980 >> Arizona!

VO Research Group

@ University of Arizona's
Steward Observatory





Tucson, Arizona



University of Arizona:

- Steward Observatory
- Lunar & Planetary Laboratory
- College of Optical Sciences

National Optical Astronomy
Observatory

Planetary Science Institute

*Kitt Peak: Mayall 4m,
WIYN 3.5m, Bok 2.3m...*

*Mt Lemmon + Mt Bigelow
3 telescopes > 1.5m...*

*Mt Hopkins
MMT 6.5m...*

Mt Graham

Chile

*Magellan 2x 6.5m,
LSST, GMT*



Vatican Observatory



Light pollution

~~1960s - Sardinia?~~

1980 >> Arizona!

1985 prototype spin cast mirror

1993 VATT dedication





Vatican Observatory





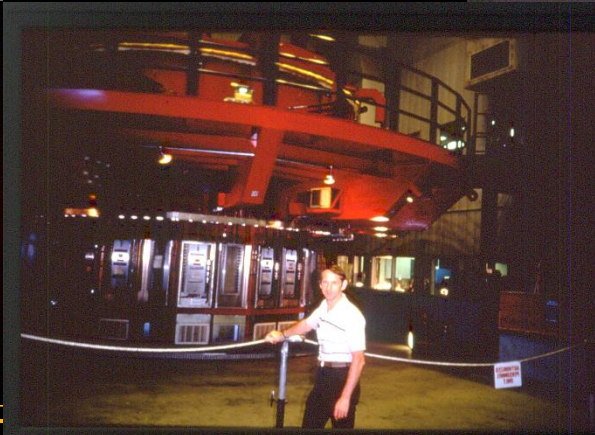
VORG – Arizona



■ Mount Graham



Vatican
Advanced
Technology
Telescope





VATT



■ Mount Graham



Vatican
Advanced
Technology
Telescope
 $D = 1.8 \text{ m}$
 $f/D = 1$





Mount Graham

- elevation = 3267 m
- sub-arcsecond seeing





Mount Graham



- elevation = 3267 m
- sub-arcsecond seeing
- our neighbors:
SMT & LBT





Funding



Vatican City State

- pays staff astronomers and some additional employees (~20 salaries)
- provides and maintains buildings in Italy and Arizona
- funds our annual contribution to the University of Arizona
- some research, incl. VATT instrumentation

Vatican Observatory Foundation (incorporated in Arizona)

- construction, operation and maintenance of VATT
- projects with strong EPO component

“Soft” sources (eg Papal Fndtn)

- research projects
- VATT upgrades, incl. robotization

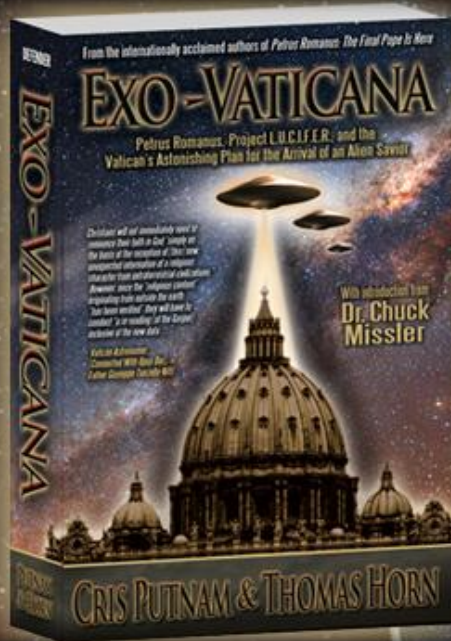


Specola's Mission





Specola's Mission



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Specola's Mission



❖ Gregory XIII – calendar reform



Specola's Mission



- ❖ Gregory XIII – calendar reform
- ❖ Leo XIII – apologetics: the Church is *not* obscurantist



Specola's Mission



- ❖ Gregory XIII – calendar reform
- ❖ Leo XIII – apologetics: the Church is *not* obscurantist
- ❖ John Paul II – science & religion dialogue



Specola's Mission



- ❖ Gregory XIII – calendar reform
- ❖ Leo XIII – apologetics: the Church is *not* obscurantist
- ❖ John Paul II – science & religion dialogue
 - ❖ "The matter is urgent. Contemporary developments in science challenge theology far more deeply than did the introduction of Aristotle into Western Europe in the thirteenth century." *Letter to Rev. George Coyne S.J. (1 June 1988)*



Specola's Mission



The Observatory is charged with a twofold mission: to explain science to the Church, and to explain the Church to the world of science. And you are much more successful in the latter.

John XXIII to Fr. Martin McCarthy, S.J.





Recruitment



VO is a “national” research institute. “Nation” @ Vatican?

Administrative practice: staffed by Jesuits and/or priests

Director (Vice Director): proposed by the Superior General of the Society of Jesus and appointed by the Pope (Cardinal in charge of the Vatican City State)

Recruitment and staffing is the responsibility of the Director.
Then: agreement between the candidate’s provincial superior and the General’s Delagate for Roman Jesuit institutions.

➔ We do not choose new staff as a function of their field; other criteria dominate.



Staff & Research



Castel Gandolfo



Jose G. Funes
Director
galaxies



Alessandro Omizzolo
galaxies



Gabriele Gionti
strings



David Brown
stellar



Robert Macke
meteorites

Tucson



Paul Gabor
Vice Director (Tucson)
instrumentation



Guy Consolmagno
President VOF
meteorites



Jean-Baptiste Kikwaya
meteors, NEOs



Christopher Corbally
stellar classification



Richard Boyle
telescope scientist
stellar populations



VATT's Instrumentation



VATT 4k CCD Imager
4064x4064 pixels @ 15x15 microns
FOV = 12.5' x 12.5'
300-1000 nm

Galway UltraFast Imager (GUFI)
FOV = 3' x 3'
readout time = 2 ms

VATT CCD Spectrograph
slit length 30", width 1"
360-950 nm
3 gratings - resolutions: 0.1, 0.2, 0.4 nm



VATT's Future



Original philosophy: testing prototype for technologies implemented on LBT (eg primary mirror thermal control capable of keeping mirror within 0.01 K of ambient).

Incremental upgrade > remote obs. (2010)

Complete overhaul under way: robotization



VATT's Future



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ProjectSoft visited in Dec 2012, submitted proposal for 3 telescopes
UA => IN-HOUSE SELECTED



VATT's Future



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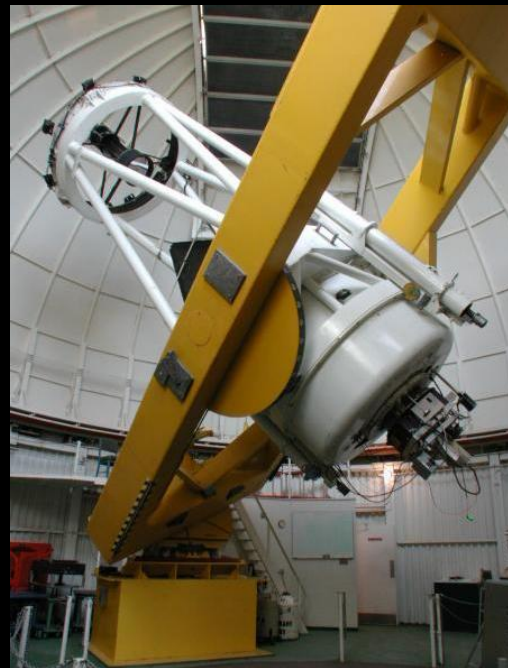
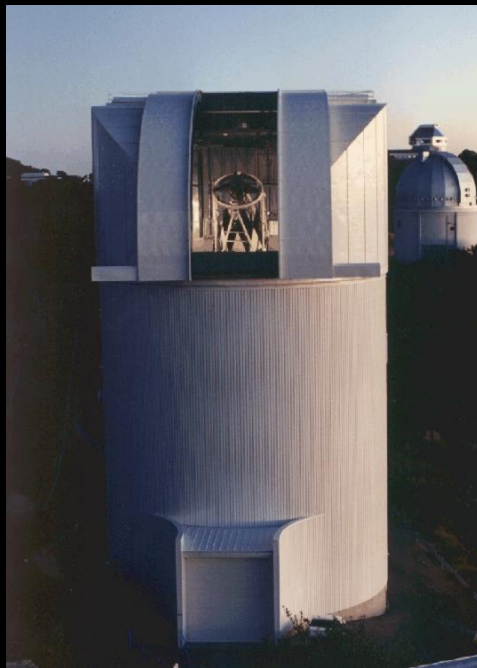
Incremental upgrade in 2010: remote obs.

Complete overhaul under way: robotization

Arizona Robotic Telescope Network



Arizona Robotic Telescope Network



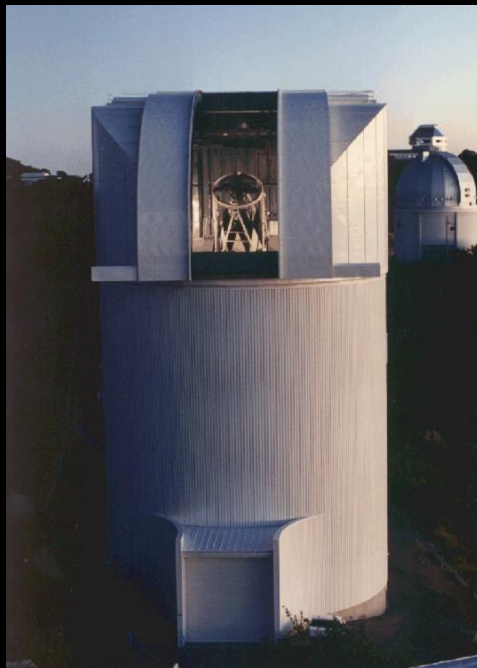
VATT
1.8 m
Mt Graham

Bok
2.3 m
Kitt Peak

Kuiper
1.55 m
Mt Bigelow



Arizona Robotic Telescope Network



+ ?

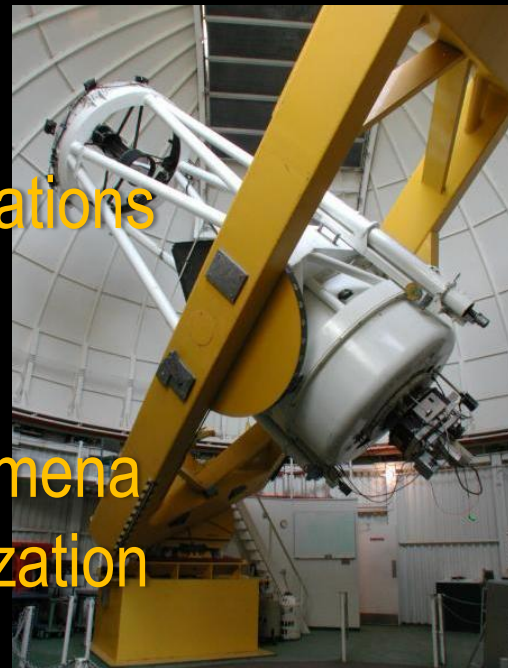
VATT
1.8 m
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Arizona Robotic Telescope Network



synoptic observations

science:
transient phenomena
NEO characterization

+ ?

VATT
1.8 m
Mt Graham

Bok
2.3 m
Kitt Peak

Kuiper
1.55 m
Mt Bigelow



Solar System



Castel Gandolfo



Jose G. Funes
Director
galaxies



Alessandro Omizzolo
galaxies



Gabriele Gionti
strings



David Brown
stellar



Robert Macke
meteorites

Tucson



Paul Gabor
Vice Director (Tucson)
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meteors, NEOs



Christopher Corbally
stellar classification



Richard Boyle
telescope scientist
stellar populations



VATT-PEPSI



fiber link
~ 400 m

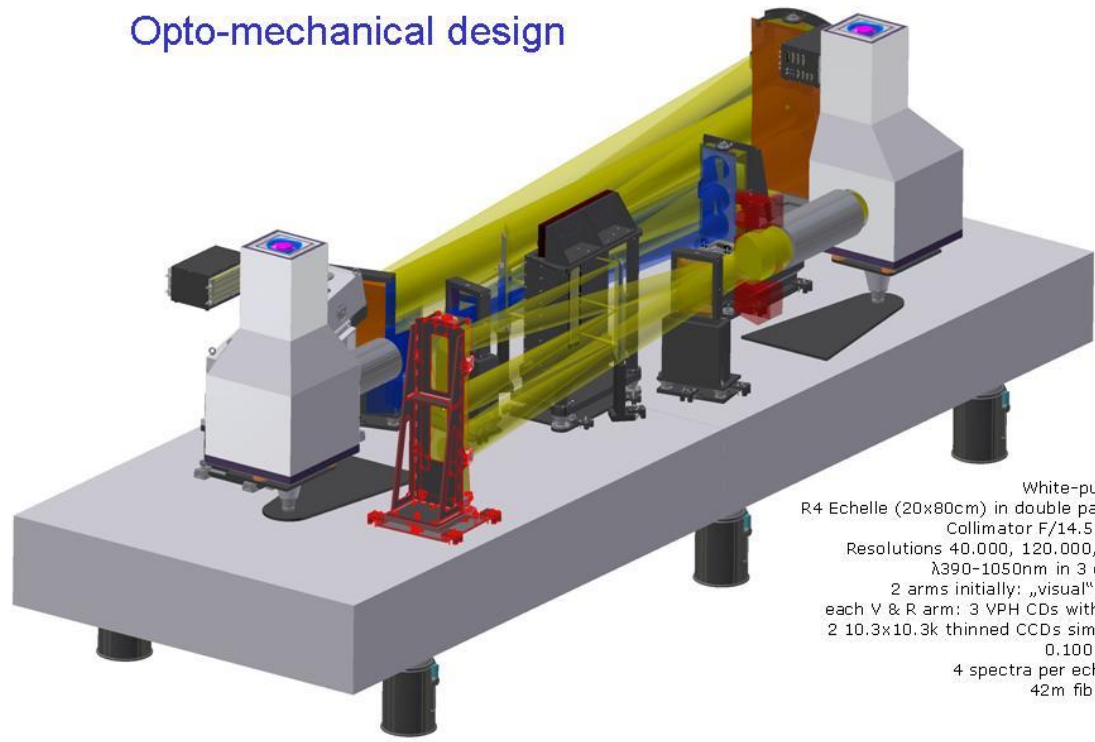
VATT
1.8 m

science:
radial velocity follow-up



Spectrograph:

Opto-mechanical design



White-pupil design
R4 Echelle (20x80cm) in double pass Littrow
Collimator F/14.5 Maksutov
Resolutions 40.000, 120.000, 300.000
 λ 390-1050nm in 3 exposures
2 arms initially: „visual“ and „red“
each V & R arm: 3 VPH CDs with 2 prisms
2 10.3x10.3k thinned CCDs simultaneous
0.100 arcsec/px
4 spectra per echelle order
42m fibre bundle

PEPSI, PI instrument @ LBT
stabilized, in LBT pier
Astrophysics Institute, Potsdam



Time on VATT?



Current time allocation:

- classic, by night
- user needs to be trained
- 25% UA Time Allocation Committee
- 75% Vatican Observatory (talk to me...)

When VATT → ARTN:

- dynamic scheduling
- all done via internet
- ?% UA
- ?% Vatican Observatory



www.vaticanobservatory.org



Thank you



Benedict XVI



The great Galileo said that God wrote the book of nature in the form of the language of mathematics. He was convinced that God has given us two books: the book of Sacred Scripture and the book of nature. And the language of nature – this was his conviction – is mathematics, so it is a language of God, a language of the Creator.

The surprising thing is that [mathematics,] this invention of our human intellect is truly the key to understanding nature, that nature is truly structured in a mathematical way, and that our mathematics, invented by our human mind, is truly the instrument for working with nature, to put it at our service, to use it through technology.

Benedict XVI, question-and-answer session with Roman youth in preparation for the Sydney WYD, St. Peter's Square, 6 Apr 2006